ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 31. No. 15. WEEKLY. | NEW YORK, WEDNESDAY, OCTOBER 13, 1897. | $3 PER ANNUM. Single Copies, 10 Cents.

Copyright, 1897, by Electrical Review Publishing Company, Times Building, 41 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

A London contemporary says that the Hamburg, Germany, police have just put a new electric launch into service in the Hamburg harbor. The boat is 29 feet long by six-foot beam and four feet deep. One charge of the accumulators will propel it at seven miles an hour for five hours, or six miles an hour for ten hours.

It is estimated that to 2,500,000 persons in this country electricity contributes a means of livelihood.

A French inventor has made use of a rubber tube as a core on which to mold pipes of cement and sand. To make a continuous conduit in the ground, a trench is dug, and at the bottom of this a layer of cement mortar. On this rests the rubber tube, which is surrounded by canvas and inflated. The remainder of the trench is then filled with cement mortar, and as soon as this is set the rubber core can be deflated and removed for use elsewhere. It is stated that six-inch pipes have been made on this plan out of hydraulic lime and sand, at a cost of about 22 cents per yard.

In repairing a cable off Cape Frio a whale was found entangled in it by the cable ship "Norseman," but it had not broken. The whale must have been there for two or three weeks and had been bitten badly by sharks.

Pres. C. C. Bonney, of the Chicago General Electric Railway Company, acting in the interests of the Yerkes lines and the Chicago City Railway Company, has filed a brief in the Supreme Court of Illinois, in which he attacks the right of a city or other municipal corporation to demand any compensation more than a license of the cars run from a street car company in consideration of being allowed the use of public streets. Mr. Bonney's argument applies to gas, telephone and other franchises. The brief was filed in the appeal of the Chicago General Electric Company from the suit of the city, in which the latter seeks to control the compensation of $500 a mile, which is agreed on in the former's franchise ordinance.

A foreign exchange states that Prince Victor Emmanuel, of Naples, is said to be an expert electrician. He experiments on all its applications to light, sound, motive power and photography, and was one of the first persons in Italy to investigate Roentgen rays.

A decision was rendered last week by the navy department in favor of the introduction of electric power in working turrets on the new battleships, which the experts believe to be cheaper, more reliable, and quicker of action. At present hydraulic power is in general use, although electricity has been successfully tried on the Puritan and the Brooklyn. The authorities propose changing the gear for the turrets of the battleships Alabama, Wisconsin and Illinois, now building, in order to conform with the new mechanism, at a cost of from $75,000 to $125,000 for each vessel. If the power works successfully on these vessels it will be applied to all other ships of the navy with turret gear.

A floating paragraph says that poultry farmers anxious to discover the laying capacity of their hens may learn by using the X rays. One large raiser of poultry was able to weed out the non-producers at the rate of 30 per hour. The "non-efficients" were soon plucked and sent to market.

A motorman in Bangor, Me., suggests that persons who want to stop a car at night strike a parlor match. The blaze, he says, can be seen by the motormen several rods away.

BARON ROTHSCHILD'S ELECTRIC GIG.

AMERICAN ELECTRIC LAUNCHES IN EUROPE.

The successful and rapid development of electric launches in this country has attracted considerable attention in foreign lands, and the American builder may therefore feel justly proud when one of Europe's richest men sends his autograph order for the handsomest electric gig which can be built, not exceeding a given length.

Such a boat has recently been completed by the Electric Launch Company, of New York city, and is to be shipped to Trieste, Austria, next week.

Baron Rothschild's Electric Gig.

Baron Rothschild limited the length to 25 feet and the weight to two tons, as the gig is to be the tender to his steam yacht, and hang at the davits when cruising. A speed rate of six miles per hour was contracted for, with battery capacity for a continuous run of three to four hours.

An engineer representing the owner made his official inspection and test of this gig last week, with results satisfactory alike to himself and to the builders.

With its complete electric power equipment and all furnishings, the launch weighed 3,890 pounds, and over a measured mile course the speed rate was found to be 7.516 miles per hour, which could be maintained nearly four hours before exhausting the battery capacity, the output of current being 53 amperes at 43½ volts.

The richest of mahogany has been used in the outer planking and decking of the boat and then finished in varnish over the natural wood. Its seating space is free from any machinery, this being beneath the floor and under the seats, with the controller under the forward deck, its shaft extending through the steering wheel bearing, so that the helmsman can both regulate the speed and direction of the craft.

This controller effects such combinations between the batteries and motor as to produce six different rates of armature revolution, and therefore of the propeller shaft, these being directly connected. Noiselessness, simplicity and cleanliness are therefore prominent features. While hanging at the yacht's davits, the batteries are to be recharged by current from the yacht's electric lighting plant, having a potential of 65 volts, to which the battery connections of the gig have been adapted.

Following this order from Baron Rothschild, the same company has recently been commissioned to construct a 37-foot electric gig for the Emperor of Russia, the order coming direct from the palace at St. Petersburg.

No limitations are specified, except that this gig is to conform closely to the type of boat built for the United States cruiser "New York," and for J. J. Astor, Esq., of whose success the Czar seems to have been well informed.

Another contract has been made with a German manufacturing company to exclusively use the apparatus of the Electric Launch Company in its electric boats, the first of which, under this contract, is now being built. The order for equipment of this boat was received last week. The boat's length is to be 10 metres (33 feet 4 inches), and beam 1.85 metres (6 feet 2 inches).

These commissions are evidently the result of a three months' trip through Europe last year by Mr. Chamberlain, the manager of the Electric Launch Company, of whose investigations the Review made mention in a recent issue.

A movement is on foot to erect a plant for the purpose of furnishing electric light to Sellersville and Perkasie, Pa. It is proposed to build a power station midway between the two places. Philadelphia capitalists are back of the enterprise.

THE COMING STREET RAILWAY CONVENTION.

THE NIAGARA FALLS MEETING, OCTOBER 19–22, PROMISES TO BE A VERY NOTABLE EVENT.

The life of Secy. T. C. Penington, of the American Street Railway Association, is just now a particularly busy one. There are a thousand and one things requiring his attention relating to the arrangements for the annual gathering of the street railway men of the United States, at Niagara Falls, October 19–22, inclusive. Much additional space had to be secured to satisfy exhibitors over what was at first supposed would be abundant, and now it seems probable that even the additional space will hardly answer the demand. All the large manufacturers of electric power machinery and street railway trucks are arranging for extensive exhibits, and a multitude of smaller exhibits will be devoted to the various machinery and devices that go to make up a modern electric railway plant. The programme as announced for the convention is as follows :

TUESDAY, OCTOBER 19, 10 A. M.

Meeting called to order by President Robert McCulloch.
Address of welcome by the Hon. A. C. Hastings, Mayor.
Calling of the roll.
Invitation extended to join the association.
Address of the president.
Report of the executive committee.
Report of the secretary and treasurer.
Reading of paper on "Municipal Ownership of Street Railways," by P. F. Sullivan, general manager Lowell & Suburban Railway Company, Lowell, Mass.
Reading of paper, "Some of the Difficulties Existing in the Construction and Operation of Electric Street Railways," by G. W. Knox, electrical engineer Chicago City Railway Company, Chicago, Ill.

ENTERTAINMENT, 2.30 P. M.

A visit will be made to the power house of the Niagara Falls Hydraulic Power and Manufacturing Company, after which the cars of the Niagara Falls and Suspension Bridge Railway Company will convey the party to the power-house of the Niagara Falls Power Company and the factories of the Niagara Falls Paper Company and the Carborundum Company.
Pleasant entertainment will be provided in the evening at the hotels, including music, dancing, etc., and a trolley party excursion to Whirlpool Rapids.

WEDNESDAY, OCTOBER 20, 9.30 A. M.

Reading of paper on "Application of Storage Battery to Electric Traction," by Charles Hewett, electrical engineer Union Traction Company, Philadelphia, Pa.
Reading of paper on "Power Distribution and Use of Multiphase Current Transmission for Ordinary Street Railways," by Maurice Hoopes electrical engineer Lynn & Boston Railroad Company, Lynn, Mass.
Appointment of committee on nomination of officers and next place of meeting.

ENTERTAINMENT, 2.30 P. M.

Party will walk across the upper suspension bridge to the Canadian side, where the cars of the Niagara Falls Park & River Railroad Company will convey party to Chippewa and Queenston, where the steam ferry of the Niagara Falls Navigation Company will be taken to Lewiston, thence by the Niagara Falls & Lewiston Railroad Company (Great Gorge route) through the gorge to Niagara Falls.
The committee will provide pleasant entertainment in the evening.

THURSDAY, OCTOBER 21, 9.30 A. M.

Reading of paper on "Discipline of Employés," by George H. Davis, superintendent of Canal and Claiborne Railroad Company, New Orleans, La.
Reading of paper on "Application of Electricity to Railroads Now Operated by Steam Power," by H. N. Heft, president Meriden Street Railway Company, Meriden, Ct.
Reading of paper on "Best Method of Settling Damage Cases and Prevention of Accidents by Use of Fenders or Otherwise," by C. G. Goodrich, vice-president and general manager Twin City Rapid Transit Company, Minneapolis, Minn.
Election of officers.

ENTERTAINMENT, 9.30 A. M.

A trip will be arranged for the ladies to Youngstown and Fort Niagara over the Great Gorge route and the Frontier Railroad, in charge of ladies' reception committee, assisted by gent'emen of the reception committee.
7 P. M. Annual dinner at the International Hotel.

FRIDAY, OCTOBER 22, 9.30 A. M.

Unfinished business.
Installation of officers.
Adjournment.

The announcement of special railroad arrangements appeared in the ELECTRICAL REVIEW last week, and it is evident that there will be a large attendance from New York and vicinity, and the committee in charge of the train, namely, Messrs. Vreeland, McGraw and Price, reports that a large portion of the space on the special train has already been engaged. All desiring accommodations should report at once to Mr. M. C. Roach, 413 Broadway, who is in charge of the special train.

The ELECTRICAL REVIEW would again remind all those who expect to attend the convention from New York city that the special train will leave here 7.30 P. M., Monday, October 18, and passengers are expected to have dined before going aboard the train, although there will be a buffet car on the train.

There are already a number of applications for the next meeting place, the latest one being from Asheville, N. C., which is, of course, a most delightful spot for a meeting of this kind to be held during the month of October. Cincinnati was, however, the first applicant for the next convention.

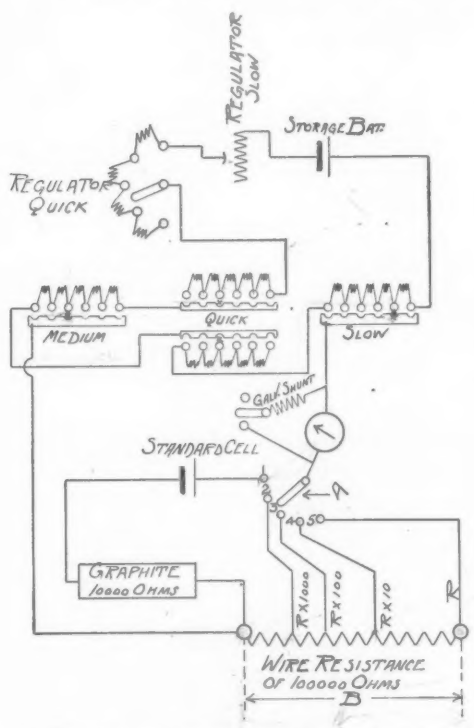


FIG. 1.—DIAGRAM OF CONNECTIONS, WILLYOUNG POTENTIOMETER.

THE EXHIBITS.

Among the exhibitors will be the following companies and firms, whose number is being added to every day:

Westinghouse Electric and Manufacturing Co., Pittsburgh.
Barney & Smith Car Co., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Walker Co., Cleveland.
Wells & French Co., Chicago.
Cambria Iron Co., Philadelphia.
John T. McRoy, Chicago.
Paul Jones, Cincinnati.
Adams & Westlake Co., Chicago.
Dilworth, Porter & Co., Ltd., Pittsburgh.
Trojan Button Fastener Co., Troy.
Bridgeport Deoxidized and Metal Co., Bridgeport, Ct.
Corning Brake-Shoe Co., Buffalo.
Murphy Manufacturing Co., Pittsburgh.
Edison-Brown Plastic Rail Bond Co., New York.
Consolidated Car Fender Co., Providence.
Christensen Engineering Co., Milwaukee.
Cutter Electric and Manufacturing Co., Philadelphia.
American Railway Supply Co., New York.
Fuel Economizer Co., Matteawan, N. Y.
Central Electric Co., Chicago.
E. T. Burrowes Co., Portland, Me.
Forest City Electric Co., Cleveland.
Pomeroy & Fischer, New York.
Cleveland Frog & Crossing Co., Cleveland.
D. J. Sinclair, New York.
J. G. Brill Co., Philadelphia.
Standard Air-Brake Co., New York.
William Wharton, Jr., & Co., Philadelphia.
Ohio Brass Co., Mansfield, Ohio.
Creaghead Engineering Co., Cincinnati, Ohio.
Falk Manufactnring Co., Milwaukee.
R. D. Nuttall Co., Allegheny, Pa.
Clarence Whitman & Co., New York.
W. F. Ellis, Boston.
Electric Mutual Casualty Association, Philadelphia.
Detroit Stove Works, Detroit.
H. W. Johns Manufacturing Co., New York.
Pennsylvania Steel Co., Steelton, Pa.
McGuire Manufacturing Co., Chicago.
Okonite Co., New York.
Peckham Motor, Truck and Wheel Co., New York.
Taylor Electric Truck Co., Troy.
Forsythe Bros., & Co., Chicago.
Rochester Car Wheel Works, Rochester.
New York Car Wheel Works, Buffalo.
New Haven Car Register Co., New Haven.
A. O. Norton, Boston.
Meaker Manufacturing Co., North Chicago.
International Register Co., Chicago.
Paige Iron Works, Chicago.
St. Louis Register Co., St. Louis.
Jonhson Co., Lorain, Ohio, and Johnstown, Pa.

In addition, track space will be occupied by Peckham Motor, Truck and Wheel Co., New York; J. G. Brill Co., Philadelphia; Duplex Car Co., Boston; McGuire Manufacturing Co., Chicago.

To Combine South Side Electric Lines in Chicago.

The territory south of Sixty-third street is now served by three distinct lines, the South Chicago City Railway, the Calumet Electric Street Railroad and the Englewood & Chicago Railway.

While the field must eventually become a very profitable one for street railways, none of these properties have fulfilled the expectations of their promoters. They have paid no dividends, the Englewood is in the hands of a receiver, and the Calumet has been taken over by the receiver of the National Bank of Illinois for satisfaction of loans.

Consolidation is believed to be the only satisfactory solution of the electric railway problem in that region, and the situation of the General Electric at present offers exceptional opportunities for the promotion of such a plan. Besides, the proposed sale of the Englewood & Chicago Electric Railway on the 12th instant to the reorganization committee may prove to be the first step toward a consolidation of it and all other southern roads with the General Electric route for a down-town trunk line. Last week it was stated that negotiations were pending on the part of the strong New York and Philadelphia interests, composing the reorganization committee of the Englewood & Chicago, for the purchase of the General Electric franchise.

Information is now received that the sale of the road was decided upon for the purpose of clearing out weak interests in the line, and that when the company is in sound condition a policy contemplating consolidation with contiguous lines will be pursued.

It is believed that no time could be more opportune for negotiations for the purchase of the South Chicago and Calumet lines than the present.

National Street Lighting Association.

The convention of the National Street Lighting Association was held at Columbus, Ohio, on September 28, 29 and 30, and elected the following officers for the ensuing year: President, D. Hunter, Jr., Allegheny City, Pa.; secretary, Charles Burton, New Haven, Ct.; treasurer, C. E. Thompson, Binghamton, N. Y.; assistant secretary, C. F. Roberts, New Haven, Ct.

In his address to the association, President Lambert made several recommendations—among others, that the convention in 1898 award a gold medal of honor for the best invention toward perfect street lighting conveniences produced within the coming year. Papers were read on electric light wiring, on the power development of Niagara Falls, and on the present state of street lighting systems in general. Mr. F. E. Barker, State gas and electric light commissioner of Massachusetts, made an argument which was opposed to municipal control of electric lighting plants. Mr. Barker referred especially in his address to the question as it existed in Massachusetts.

TELEPHONE NEWS AND COMMENT.

The American Telephone and Telegraph Company, who are now building towards La Crosse, Wis., are meeting with considerable opposition in securing a franchise for entrance into that town.

The Kinloch Telephone Company is getting ready to set up poles on Missouri avenue, St. Louis. The company announces that it will begin serving its patrons in East St. Louis at the same time as in St. Louis.

The franchise of the Home Telephone Company, as granted by the city of Tiffin, Ohio, specifies that five telephones shall be used by the city free of cost, and that additional telephones may be rented for city or school-board purposes at $1 per month.

The Union, Ore., Telephone Company has completed its line to Cornucopia, covering a distance of about 75 miles, and the line is now open for business. This line gives rapid communication to a large section of the country, including some of the richest mineral fields in eastern Oregon. The company now has a force of men at work building a line from Union to Baker city.

The rival telephone companies of Des Moines, Iowa, are in a cutthroat war for the business of the city. The old company, the Iowa Central, has cut its rates 50 per cent, in order to hold business, while the new Mutual company, which is just beginning the operation of a new exchange, has the backing of a large part of the business community. The retail grocers and butchers and the physicians of the city have agreed to patronize the new company exclusively.

President Samuel Bryan, of the Chesapeake & Potomac Telephone Company, is arranging for a very elaborate telephone system for the government departments at Washington. Among these are the Museum, Senate, General Post Office, the United States Treasury, the Government Printing Office and the House of Representatives. It is thought that telephones will soon be placed also in the Department of Justice, in the State building, and probably in the Pension Office and the White House. In each instance a local exchange will be installed, and so arranged that each telephone may be connected with the entire system.

The Mayors' Convention.

About 600 Mayors and Councilmen recently met in convention at Columbus, Ohio, and formed the League of American Municipalities. The following officers were elected: President, Mayor John McVicar, Des Moines, Iowa; vice-president, Mayor C. A. Collier, Atlanta, Ga.; secretary, B. F. Gilkison, New York; treasurer, Mayor Samuel L. Black, Columbus, Ohio. Trustees: Mayor John Warner, Peoria, Ill.; President of Council Fred A. Walker, and President of Council C. M. Leitch, Wilmington, Del. The sessions of the convention covered four days, from September 28 to October 1, inclusive, and were taken up in a discussion of municipal problems in general. Papers were read on the use of the telegraph in fire and police service, paving, municipal water and light plants, municipal street cleaning, and an address on "The Modern Construction and Maintenance of Electric Wires and Their Supervision by Municipalities," by Capt. William Brophy, of Boston.

After some debate the following resolutions, offered by Mr. A. J. Boardman, were adopted:

"Whereas, This national conference of Mayors and members of city councils has been informed that the United States Department of Labor has undertaken an investigation of water, gas and electric lighting works, and a clear outline of the methods, form and purposes of this investigation has been given by Mr. Allen Ripley Foote, in a paper read before this conference under the title of 'Cost of service to users and taxpayers; a proper basis for comparisons between private and municipal ownership of water, gas and electric lighting works;' and, whereas, Hon. Carroll D. Wright United States Commissioner of Labor, has announced that the object of this investigation is to enable municipalities and the citizens thereof to determine whether there is any economic advantage to consumers in the municipal ownership and operation of water, gas and electric lighting works; and, whereas, such an investigation by the expert and impartial authority of the United States Department of Labor, which can reach every municipality in the United States, is sorely needed, and will have a vital and far-reaching influence in correctly guiding public policy on this question of paramount importance to all municipalities; therefore, be it

"*Resolved*—First, That this conference cordially approves of the investigation as set forth in Mr. Foote's paper, to be made for the purpose stated by Hon. Carroll D. Wright, United States Commissioner of Labor.

"Second, That the delegates to this conference tender to the United States Department of Labor, and to its duly accredited agents, their co-operation in every practical way to facilitate this investigation in their respective municipalities, and to make the information collected complete and accurate.

"Third, That it is the sense of this conference that the executive and legislative officers of all municipalities, and the managers of all public service corporations, should promptly and cordially do whatever may become necessary on their part to expedite the work of this investigation, to the end that through it statistics may be secured that will be accepted by all persons as reliable basis for comparisons."

The question of municipal ownership was rather warmly discussed. Detroit was selected as the next meeting place of the League of American Municipalities.

The Willyoung Direct-Reading Potentiometer.

In the accompanying illustrations is shown a new form of direct-reading potentiometer, recently put upon the market by Willyoung & Company, Philadelphia. The first of these instruments was designed for and supplied to the new Standardizing Laboratory of the Electrical Engineering Department at the University of Nebraska.

Fig. 2 shows the component parts of the apparatus in skeleton, while Fig. 1 shows the same, but spread out in diagrammatic outline. The general scheme will be seen to be essentially the same as that used in the potentiometer discussed by Mr. Willyoung in a paper read before the American Institute of Electrical Engineers in Philadelphia, 1893.

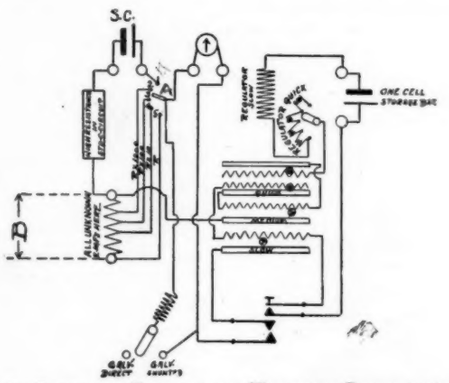


FIG. 2.—COMPONENT PARTS OF THE WILLYOUNG POTENTIOMETER.

The main potentiometer circuit contains three groups of adjusted resistances; viz., "quick," "medium" and "slow." There are nine coils in "slow," each of 0.08 ohm resistance. "Medium" has nine coils also, each of 0.8 ohm resistance, or ten times that of a coil of "slow. In "quick" there are two sets of coils, 14 in each set, and each coil of eight ohms resistance. By means of this "quick" group we are enabled, if we keep plugs in corresponding holes of both bars, to take resistance out from between the galvanometer circuit terminals, while maintaining the resistance of the main circuit always constant. The coils of "quick" are designated consecutively 0.1, 0.2, 0.3, 0.4, etc., up to, and including, 1.4; those of "medium," 0.01, 0.02, 0.03, 0.04, etc., up to, and including, 0.09; and the coils of "slow," 0.001, 0.002, 0.003, 0.004, etc., up to, and including, 0.009. In the operation of the instrument (See Fig. 1), switch "A" is turned to point 1 (thus opposing the standard cell circuit to that of the storage battery). The plugs of "quick," "medium" and "slow" should then be set to read off the value of the standard cell—for a Carhart-Clark cell having electromotive force of 1.440 the three settings should be 1.4, 0.04, and 0.000. "Regulator quick" and "regulator slow" are now adjusted until there is no deflection of the galvanometer on closure of the circuits.

FIG. 3.—THE WILLYOUNG POTENTIOMETER.

To measure now any unknown electromotive force, join the same to the binding posts "B," turning switch "A" to one of the points 2, 3, 4, or 5, depending upon the probable value of the unknown electromotive force. If less than 1.5 volts, turn "A" to 5, move the plugs till balance is obtained, and read the plug settings which will be the electromotive force desired. If between 1.5 and 15 volts, turn "A" to 4, balance, and read as before, and multiply reading by 10.

The potentiometer is capable of measuring electromotive forces up to 1,000 volts with an accuracy of one-tenth per cent. Currents of any value may be measured by means of a standard known low resistance; the unknown current should be passed through this, and the potential difference produced by this current at the terminals of the resistance measured by the potentiometer.

It is now generally recognized that no method can compare with the potentiometer method for quickly and accurately calibrating voltmeters and ammeters. The only possible elements of change are the standard resistances and the standard coil. As to the former, the experience of many years has shown that the percentage of change in thoroughly well made resistances used with any kind of care is extremely small. That the resistances should change among themselves is still more unlikely, and it is merely their ratios that require to remain constant. Standard cells can not be relied upon quite so thoroughly; still experience has shown that even the standard cell may be depended upon not to change in value by more than four or five parts in 10,000 in several years' use. Standard cells are cheap and easily replaced, even if they do change, while the resistances may easily be checked up among themselves for inaccuracy at any time by use of an ordinary Wheatstone bridge. Mr. Jas. G. Biddle, of Philadelphia, selling agent for the Willyoung apparatus, will be pleased to give further details regarding this instrument.

Electric Light Injunction in Brooklyn, N. Y.

Justice Gaynor has granted a temporary injunction restraining the Amsterdam Electric Light and Power Company, the State Electric Light and Power Company, Noah L. Cocheu and Frank A. Remnan from doing business in Brooklyn, N. Y., under franchises granted in 1893 to the State Electric Light Company. The various companies have become considerably involved, and several suits are pending.

OUR CANADIAN LETTER.

LISTOWELL, ONT.—Plans for electric lighting and power are now under consideration by the town.

VERNON, B. C.—By-law to raise $12,000 for an electric light plant has been carried by the rate payers.

LONDON, ONT.—The extension of the electric railway to Pottersburg has been decided. It will cost $7,000.

GRAND FORKS, B. C.—The council have decided to borrow $20,000 for the purpose of constructing an electric light plant.

GLENCOE, ONT.—George Wilson, municipal clerk *pro tem*, is receiving tenders for electric street lighting for a term of five years.

SARNIA, ONT.—The Sarnia *Observer* states that a project is on foot to construct an electric railway from Sarnia to Weisbeach.

LANARK, ONT.—At a meeting held recently it was passed to favor the granting of a bonus of $10,000 to the Lanark County Electric Railway.

BROCKVILLE, ONT.—The prospects of an electric street railway in Brockville are bright. It is stated that a company will begin operations early next Spring.

LEAMINGTON, ONT.—W. Stares, representing the Leamington Electric Light Company, has requested permission from the town to run electric cars within the limits of the corporation.

REVELSTOKE, B. C.—The Electric Light Company have cleared the ground upon which they propose to build the power-house and other buildings. The flume will be nearly 2,000 feet long.

TORONTO, ONT.—A sub-committee, appointed to consider the advisability of establishing a municipal electric light plant, has recommended to the council that an electrical expert be employed to make a report thereon.

BILLING'S BRIDGE, ONT.—A company has been organized to furnish the village with electric light. Included in the company are the following: James Perry, civil engineer, Ottawa; R. Anderson, electrician, Ottawa, and A. Graham, brickmaker, East Ottawa.

CHATHAM, ONT.—The Chatham City & Suburban Railway Company desires the enlargement of its powers by the right to run north from the city through the Township of Dover to Mitchell's Bay, thence to Wallaceburg and Petrolea. G. E. Rankin is one of the chief promoters.

KINGSTON, ONT.—Great interest has been taken in the electric road scheme from Thousand Island Park to Westminster, a distance of seven miles. The road can be constructed for about $7,000. Ex-Mayor H. E. Inglehart has signified the intention of giving $2,000 to the project.

Montreal, October 9. J. A. C.

Lord Rayleigh has been elected an honorary member of the Swiss Society of Natural Science.

The Success of the Alternating Inclosed Arc Lamp.

The "Puritan" arc lamp during the last two years has been very widely adopted by central stations, as it embodies a number of features which heretofore have not been overcome in arc lighting. This type of lamp seems to obviate certain faults and failings of the old open arc. A prominent electrician who has been closely identified with some of the best construction work in America remarked the other day when looking at one of these lamps: "The difficulties encountered in the application of arc lamps to alternating-current circuits have largely been overcome since the present form of lamp has been on the market, and unquestionably the art of electric lighting has been more affected by these recent improvements than is appreciated by those who have not considered this question."

"PURITAN" INCLOSED ALTERNATING ARC LAMP.

The Puritan lamp, manufactured by the Puritan Electric Company, of New York and Boston, is designed to burn upon a secondary voltage anywhere between 90 and 120 volts, and taking six amperes of current, the total wattage of the lamp will range between 400 and 450, of which all but 25 watts are actually consumed at the arc in producing light. The mechanism is simple and not easily deranged, and 100 hours' life is obtained from the seven and one-half inches by one-half inch carbons, the upper and lower carbon being of the same length.

It is adaptable for use for both inside and outside lighting, and the humming and buzzing common to the old alternating arc has been entirely eliminated, making it unobjectionable in even the most confined quarters, while its short length makes it adaptable to the lowest ceilings.

No special transformers or economy coils are necessary, and the lamp is entirely self-contained and burns in multiple.

Water-Power and Electricity.

[*From the London Spectator.*]

The closing years of the nineteenth century—a century which has been so full of change and marked by progress in so many directions—are ushering in a change perhaps more important in its significance for our own country than any that has preceded it, even in this century of progress. This change is foreshadowed by the striking developments of water-power for industrial purposes that have been witnessed in both Europe and America during the last six years—developments which would appear to point to the substitution of water-power for steam-power in industry at some future date, and to the transfer of the chief manufacturing industries from those countries rich in the possession of coal to those rich in the possession of this modern rival of coal; namely, water. The recent development has been chiefly due to the progress of electrical science, and the successful application of water-power on a large scale to industrial purposes adds one more to the large number of triumphs with which the electrical engineers of the present age must be credited.

The water-wheel has been replaced by the turbine, which can be adapted to any head of water, and by means of which water-powers of the greatest magnitude may be successfully developed for industrial purposes. The head of water under which the old mill-wheels were worked rarely exceeded 20 feet, and was generally much below that limit; to-day heads of water of 140 feet and 210 feet are being used at the two power plants at Niagara Falls, and at Fresno, in California, there is a water-power plant working under a head of 1,400 feet. When it is remembered that the height or head of water is one of the factors which determine the amount of energy developed, the significance of these figures is apparent. As regards the amount of power developed under the old system, 100 horse-power might be regarded as a maximum; to-day there are at Niagara single turbines which produce 5,000 horse-power, and there is no proof that even these enormous wheels represent the limit in size which may not be safely exceeded.

Even more important than the results which have come from the substitution of the turbine for the older water-wheel are those which have been produced by the introduction of electric transmission. In the older system the machinery in the mill had to be coupled directly to the water-wheel by shafting and gearing, and hence these old mills were necessarily built upon the banks of the rivers and streams which provided them with power. In the modern system of transmission by alternating electric currents, the mechanical energy developed by the turbine is converted on the spot into electrical energy by means of the dynamo, and this electrical energy is then carried by air lines to the locality where it is to be used. Thus the modern factory or mill driven by water-power need not necessarily be situated in mountain-locked valleys, miles from the nearest railway and remote from the industrial centers of the district. It may be built wherever the natural and economic conditions are most favorable to the manufacture, and the electrical energy developed miles away can be delivered at the factory by an air cable as easily as water may be delivered through pipes from a distant reservoir in the hills. The greatest activity in the application of these modern methods for the utilization of water-power is now being displayed in both Europe and America, and the following figures, which represent the aggregate horse-power already developed, or in course of development, will give some idea of the wonderfully rapid advance that has occurred in recent years in this branch of engineering science.

In America the total of the larger installations is 72,000 horse-power, with the prospect of this total being increased to 150,000 when the Niagara scheme is completed. In addition to this, there are a very large number of smaller plants in operation in the mining districts of Colorado and Nevada. Switzerland occupies the second place with 32,000 horse-power. This will be increased to 48,000 when the second water-power plant on the Rhone, near Geneva, is completed. France follows with 18,000 horse-power, which will be increased to 30,000 by the completion of the power plant near Lyons. Germany has only one water-power of any magnitude—that at Rheinfelden. This will yield 16,000 horse-power when completed. Italy has 18,000 horse-power; Sweden and Norway between 10,000 and 20,000 horse-power each, with almost limitless possibilities of further development, while England and Scotland come at the end of the list, with only 4,000 horse-power.

The purposes for which this power is being utilized are exceedingly varied. It is used directly as electrical energy for lighting purposes, and for chemical and metallurgical operations. Transformed again into mechanical energy by means of the electric motor, it is used for working tramway systems and for driving machinery of all kinds, at the mines or in engineering and other workshops. The significance of this new step forward in the application of water-power to industrial purposes is startling. On the one hand it signifies that man has at last learned how to effectually master and utilize one of the mightiest natural forces of the earth. Coal is an exhaustible possession, and the day must come when the coal fields of the earth will be worked out. Our rivers and falls offer, on the other hand, an inexhaustible supply of energy; for so long as the heat of the sun evaporates the water of the sea and causes it to fall again as rain upon the hills, or as snow upon the mountains, this source will be available for the supply of man's wants, and the arrival of the time when the earth's coal fields will be exhausted need no longer be awaited with misgivings.

The Lady and the Telephone.

Act I—In the rooms of the All Around Club. Charlie Careful and Reginald Quick discovered seated, with their feet elevated on the window sill, gazing out into the street. Both men are smoking.

Charlie (suddenly)—Reginald, I have an idea!

Reginald (surprised)—For heaven's sake!

Charlie (confidently) — Yes — you wouldn't believe it.

Reginald (positively)—No.

Charlie—Well, I have. I think I will get married.

Reginald (dubiously)—How long since?

Charlie—Some time. I have been deliberating over the matter for two months. I am growing tired of this bachelor existence. It's stupid—with apologies to you—killing time here in the club. I am sure, with my income and my quiet ways, I could make some girl happy. You see——

Reginald (interrupting)—Certainly, old man; there is no doubt about it. But "some girl" is too indefinite. You mean "one girl." Men in your state of mind always mean a particular angel. Name her.

Charlie (hesitatingly)—You know her.

Reginald—I do?

Charlie—Yes.

Reginald (after a pause)—Well?

Charlie—And I rather think you like her.

Reginald (a light dawning upon him)—You mean Nellie——

Charlie (interrupting)—Yes; Nellie Summergirl.

Reginald (startled)—Have you proposed to her?

Charlie—No; but do you think she would throw me over?

Reginald—Why don't you ask her?

Charlie—By jove, old boy, that is the very thing I am going to do!

Reginald—When?

Charlie (enthusiastically) — Now; this very afternoon. No time like the present, you know. I will go and see her right away. Reggie, old man, give me your blessing. By-bye! (Exit.)

Reginald (soliloquizing) — Well, Reggie, you must hustle if you don't want to lose the best thing in the world. (Departs smiling.)

Act II—At the telephone.

Reginald—Hello! Central! Give me 444. (After a pause.) Is that 444? * * * * Thank you. Is Miss Summergirl at home? * * * * No? * * * * Out driving? * * * * And when do you expect her? * * * * Very soon? * * * * Yes, I will call her up again in a little while. * * * * No, needn't mind about the name, I will call again later.

Act III—In the drawing-room of the Summergirl residence. Miss Summergirl, suddenly appearing in driving costume, discovers Charlie Careful awaiting her return. She greets him cordially.

Miss Summergirl—How are you, Mr. Careful? Isn't it a lovely afternoon?

Charlie—Delightful, I assure you. And have you had a pleasant drive?

Miss Summergirl—We went miles and miles. I saw Jack Towers and his wife and—(here Miss Summergirl begins reeling off a long string of names, during which Charlie Careful grows more and more nervous.)

Charlie (at the first break in the conversation)—Miss Summergirl, I came here on a really important matter.

Enter Nancy, the housemaid.

Nancy—Miss Nellie, some one wants you at the telephone.

Miss Summergirl—Wants me?

Nancy—Yes'm. (Exit.)

Miss Summergirl—Will you excuse me, Mr. Careful? I will return in a moment. (Exit.)

Charlie (alone)—I really believe that now I have the courage to ask her.

Act IV—At the telephone in the Summergirl residence.

Miss Summergirl (with the transmitter before her and the rubber trumpet up to her ear)—Well? * * * * Yes, I am here. Who is it talking? * * * * Mr. Quick? Oh, how do you do? * * * * I am glad to hear it. You say you have something important to ask me. That's funny. Mr. Careful said the same thing a minute ago. What? * * * * Yes, he is here. * * * * WHAT? Has he proposed to me? Oh, Mr. Quick, what are you talking about? * * * * That was what he came for? * * * * No, if he hasn't asked me, how could I have accepted him? * * * * WHAT? * * * * Will I marry you? * * * * This is so sudden! * * * * Whoever heard of such a thing? * * * * Want my answer now? * * * * Well, YES! And, Reginald—doesn't that sound funny?—say, Reginald, come up here right away. He'll go pretty soon.

FIG. 1.—PARLOR ELECTRIC HEATER.

Act V—In the drawing-room of the Summergirl residence. Miss Summergirl reappears with radiant face and excited manner. Mr. Careful's courage is at the sticking point.

Charlie—As I was saying, Miss Summergirl — Nellie! Oh, Miss Nellie—Nellie—I came here to ask if you would be my wife! We would have such a lovely wedding, and we would go abroad and——

Miss Summergirl (smiling) — Really, Mr. Careful, I have just accepted another man!

Charlie (looking with surprise around the room)—How?

Miss Summergirl—Over the 'phone. When I went out just now.

Charlie—And who, if I may take the liberty of asking?

Miss Summergirl—Mr. Reginald Quick! Tableau.—*By Henry Litchfield West in Washington Post.*

ELECTRIC LIGHT FLASHES.

A stock company is being organized at Carrollton, Ky., to lease the waterworks plant of the city and put in an electric light plant in connection with it.

At the annual meeting of the Trenton, N. J., Light and Power Company the following directors were elected: James Moses, John Moses, Charles J. Hughes, Dallas Reeves, Alexander C. Yard, Garret D. W. Vroom, Richard A. Donnelly, William C. Allen.

Detroit capitalists have organized the Norway Electric Company at Norway, Mich. Its object is the supplying of cities and villages with electric light. The capital stock is $12,000. The company has purchased the water-power of the Sturgeon River from Hamilton & Merriman, of this city, with a capacity of 2,000 horse-power.

The Goshen, N. Y., Light and Power Company will enlarge their power-house by an extension of 20 feet on the front, and a new 125-horse-power engine and two large dynamos will be put in. During five years a floating debt of $6,000 has been reduced to $2,000, and the company will offer for sale $6,000 in bonds to pay for the improvements and the balance of the floating debt.

The Royal Gorge of Colorado is to be lighted with electricity. The running time of the trains through this remarkable canyon is so arranged that tourists are compelled to pass through it at night, and are thus prevented from viewing its beauties. To obviate this the railroad company proposes to make it as light as day, and, if anything, to add to its scenic beauties, because of the accentuated lights and shadows which must play over and between the rocks.

Parlor Electric Heaters.

The portable electric heaters shown on this page are suitable for the parlor, office, hall, in fact, are adapted for any place a stove is desirable, and can be placed in many locations where a stove could not be used without danger. They are manufactured in Philadelphia, by the Globe Electric Heating Company, and are the latest application of electric heating to the convenience of the public. They supply two grades of heat, the wire connection being at the bottom, and one-half the coils, shown in Fig. 2, can be used when the full heat is not desired. The heater contains 20 heating coils, each coil consuming one-half of one ampere on 110-volt circuit. To determine the heating capacity of this heater the manufacturers calculate one watt of electric energy to every two cubic feet of air space. This rule will hold good in well constructed buildings, with the outside temperature at 32 degrees Fahrenheit. The sizes are: Height, 26 inches; diameter, 14 inches; weight, 35 pounds.

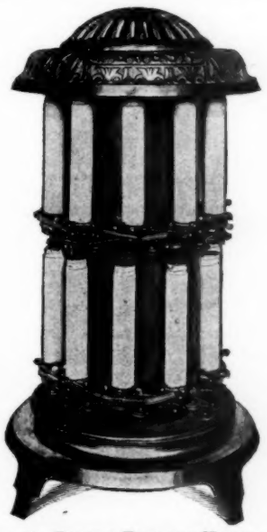


FIG. 2.—PARLOR ELECTRIC HEATER—COVER REMOVED.

ELECTRIC RAILWAY NOTES.

The Salem, Mass., and Wakefield Street Railway Company has organized, with Charles F. Woodford as president, and G. A. Butman, treasurer and clerk.

The Petaluma, Cal., Street Car Railway has been sold at Sheriff's sale to Wickersham Banking Company for $2,356.83. The property consists of land, rolling stock and franchise. The bank officials have not made public their plans for the road.

The jury in the damage suit of Jerry Nelson against the Little Rock, Ark., Traction and Electric Company brought in a verdict recently awarding the plaintiff $3,000. The amount asked for was $22,000. This was the case where Jerry Nelson, a boy 11 years of age, lost a leg on the East Ninth street car line in Little Rock.

The two street railway companies of Cleveland, Ohio, have submitted a proposition to the City Council, offering to sell six tickets for 25 cents, give general transfers, and pay an unspecified percentage of the gross receipts into the city treasury, asking in return an extension of existing franchises for 25 years from the date of their last renewal.

The Springfield, Ill., Street Railway, which is owned and managed from Louisville, Ky., desires, it is reported, to raise money for betterments and asks that its bondholders surrender the January two and one-half per cent semi-annual coupon and agree to accept three per cent per annum hereafter for three years. The road has been operated for years and has acquired a floating debt of $68,000.

The suits of William Alexander Cullen and Alexander Cullen, father and son, of 211 Second street, Jersey City, N. J., against the Consolidated Traction Company, for damages because of injuries received by young Cullen, who had both of his legs taken off by a trolley car in front of No. 2 School, on Erie street, on April 22 last, have been decided against the company. Mr. Cullen, pere, sued for the loss of his son's services pending his majority, and the jury awarded the father $2,500. Young Cullen was awarded $10,000 for the loss of his limbs, making the total verdict against the company $12,500.

The Santa Rosa, Cal., & Sonoma County Electric Railway Company has finished 15 miles of surveying in the neighborhood of Sonoma, but will not do any more active work in the field pending a disposal of $400,000 of its bonds in New York and London. The company intends to build 70 miles of narrow-gauge electric railroad in Sonoma County. The line will start from Embercardero, which is on the bay, and run by the way of Sonoma, Santa Rosa, Lytton Springs and Healdsburg, to Calistoga. The Sonoma Board of Supervisors has given the company a right of way on one side of all the main county roads. The company estimates that the line will cost not over $10,000 a mile to construct. The directors have authorized an issue of $700,000 in bonds for the total expense.

Electrical Review

Times Building, 41 Park Row,

P. O. Box 2339. **NEW YORK.**

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

1546 "CORTLANDT," TELEPHONE CALL.

WESTERN OFFICE:
CARL E. KAMMEYER, Representative,
1627 MONADNOCK BLOCK, CHICAGO.
Telephone–Harrison, 475.

LONDON OFFICE:
HENRY W. HALL, Representative,
42 OLD BROAD STREET, LONDON, E. C.
News, Subscriptions and Advertisements.

Subscription to the
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10

Copies can only be supplied for one year back at 25 cents each.

Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication on the following week.

NEW YORK, OCT. 13, 1897.

CONTENTS.

	PAGE
Views, News and Interviews	171
Baron Rothschild's Electric Gig	171
The Coming Street Railway Convention	172
To Combine South Side Electric Railway Lines in Chicago	172
National Street Lighting Association	172
Telephone News and Comment	173
The Mayors' Convention	173
The Willyoung Direct-Reading Potentiometer	173
Electric Light Injunction in Brooklyn, N. Y	173
Our Canadian Letter	174
The Success of the Alternating Inclosed Arc Lamp	174
Water-Power and Electricity	174
The Lady and the Telephone	175
Electric Light Flashes	175
Parlor Electric Heaters	175
Electric Railway Notes	175
Turning Turrets by Electricity	176
Interesting to Steam Railway Men	177
Mail Sent by Pneumatic Tubes	177
Obituary	177
American Electro-Therapeutic Association	177
Personal	177
A Strong Electrical Union	177
Economy in Electric Car Control	178
Electric Railways in Great Britain	179
Street Car Air-Brakes in Great Britain	179
A Prominent Manufacturing Company Moving to Bronxville, N. Y	179
Electric Traction on Common Roads in 1895	180
Telephone Service in New York Residences	180
Advantages of Up-to-Date Street Railroad Service—Why the Rate of Fare Should Not Be Reduced	181
Electrolytic Etching	181
Advance Information	182
Kindred Interests	ix
Electrical Patents	x
Kind Words	x

INDEX OF ADVERTISERS.

COVER PAGES.	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire	i
Babcock & Wilcox Co	xvi
Bogart, A. L	i
Bristol Co., recording voltmeters, etc	i
Bunnell & Co., J. H., dry batteries	i
Clonbrock Steam Boiler Co	xvi
Columbia Incandescent Lamp Co	i
Crefeld Electrical Works	i
Crocker-Wheeler Electric Co	i
Day's Kerite, insulated wire	i
Diehl Manufacturing Co	ii
Electric Appliance Co., supplies	i
Fort Wayne Electric Corporation	i
Goldmark & Wallace, "Koch" dynamo brushes	i
Imperial Porcelain Works	xvi
Iron Clad Rheostat Co	i
Leffel & Co., Jas	xvi
Lombard Water-Wheel Governor Co	xvi
McKenney & Waterbury	i
National India Rubber Co	i
New York Insulated Wire Co., Grimshaw wires and cables	i
Okonite Co., insulated wires and cables	i, xvi
Orient Electrical Co	i
Partrick & Carter Co., electrical supplies for housework	i
Standard Underground Cable Co	i
Stirling Co., water-tube boilers	xvi
Thayer & Co	i
Van Nuis, C. S	i
Vulcan Foundry Co	xvi
Westinghouse Electric & Mfg. Co	ii

INSIDE PAGES.

American Bell Telephone Co	xiii
American Electric Telephone Co., long-distance telephones	xiii
Andrews-Ryan Co., telephone engineers	xiii
Armorite Interior Conduit Co	xi
Baker & Co., platinum	ix
Ball & Wood Co., engines	xi
Berlin Iron Bridge Co	xiv
"Big Four" R. R	x
Brill, J. G., Co	xiv
Brixey, W. R., Day's kerite wires and cables	viii
Buckeye Electric Co	iv
C & C Electric Co	vii
Central Electric Co., electrical supplies	iii
Central Manufacturing Co	xiii
Chicago Edison Co	x
Connecticut Pipe Mfg. Co	xiv
Correspondence School of Technology	ix
Dixie Company	x
Dixon, Jos., Crucible Co., belt dressing	xiii
Duval, E. S., Jr., patents	x
Dyer & Driscoll, patent solicitors	x
Eastern Electric Cable Co	vii
Edison Decorative and Miniature Lamp Dept	viii
Electrical Mercantile Agency	vii
Electrical Specialty Co	iii
Electric Storage Battery Co	iii
Empire China Works, porcelain specialties	xiv
Eppinger & Russell Co., Valentine subway electrical conduit	xiv
Eyanson & Armpriester	xiv
Faraday Carbon Co., carbons	viii
Farr Telephone & Construction Supply Co	xiii
Forest City Electric Co	xiv
General Electric Co	vi
Gordon-Burnham Battery Co	x
Hamilton Publishing Co	x
Hemingray Glass Co	xi
India Rubber and Gutta Percha Insulating Co	xiv
International Correspondence School	ix
Jewell Belting Co	iv
Keystone Electrical Instrument Co	viii
Lehigh Valley Creosoting Co., creosoted lumber	ix
Locke, Fred. M	iii
Lockwood Long-Distance Telephone & Telegraph Co. of America	xiii
Lynn Incandescent Lamp Co	iii
Manhattan Optical Co	vii
Marshall, Wm., condensers	x
McIntire Co., The C	ix
McLennan & Co., K	viii
New England Engineering Co	v
New York Central & Hudson River R. R	vi
New York Telephone Co	ix
Novelty Electric Co., supplies	vi
Ostrander, W. R., & Co., supplies	x
Pacific Electric Co	ix
Paiste, H. T., Co	ix
Phillips Insulated Wire Co., wire	viii
Reisinger, Hugo	viii
Ritchie, E. S., & Sons	vi
Rodrigues, M. R	xiv
Roebling's Sons Co., John A., bare and insulated wire	v
Royce & Marean, electrical supplies	ix
Safety Insulated Wire and Cable Co	ix
Sawyer-Man Electric Co	iv
Schiff, Jordan & Co	vii
Siemens & Halske Electric Co. of America	vii
Solar Carbon & Mfg. Co	xiii
Sterling Supply & Mfg. Co	xiv
Thompson, E. P	x
Viaduct Mfg. Co., telephones, etc	ix
Wabash Railroad Co	vii
Wedderburn, John, & Co., patents	x
Western Electric Co	xii
Western Telephone Construction Co	xiii
Westinghouse Electric & Mfg. Co	iv
Weston Electrical Instrument Co., measuring instruments	viii
White & Co., J. G., engineers and contractors	ix
Willard Battery Co., storage batteries	x

Last week at Rochester, N. Y., another explosion of acetylene gas occurred which resulted in the blinding of one man and in severely injuring another. The accident resembles in many ways the one which occurred several months ago in a Connecticut machine shop. Three machinists in Rochester were engaged in making a pattern for a new valve to be used on a tank containing acetylene gas. A gas jet was burning just above the tank, and while all three men were engaged in their work the tank suddenly exploded. A device which can not be handled with safety by experienced machinists has no place as an article of public service.

The Metropolitan Street Railway Company, of New York city, is to be congratulated on its adoption of the semi-military system in handling its large army of employés. The principal innovation decided upon is the use of service stripes to indicate the length of time the men have been in the employ of the company. For each year of service up to, and including, the fourth the employé will be entitled to one blue stripe on the sleeve of his uniform coat. After the first five years the blue stripes are to be discarded and replaced by one gold stripe. For every subsequent five years another gold stripe will be added. The company has employés in its service who have been on the road for more than 30 years. Uniforms and clean linen give an air of dignity and respectability to street railway employés which is only equaled by the moral effect on the men themselves. As a rule they are proud of their uniforms and very frequently obstreperous passengers are impressed by the outward and visible evidence of authority which a uniform always inspires.

Electrical manufacturers, as well as others, should be interested in the effective work being done by the executive committee of the Indianapolis Monetary Commission, of Indianapolis, Ind. This convention, which met at Indianapolis last Winter, was representative of the business interests of the country, and laid down a brief platform which contains three principles: That the present gold standard should be maintained; that means should be adopted to insure the ultimate retirement of all classes of United States notes by a gradual and steady process; and that a banking system should be provided which should furnish credit facilities to every portion of the country and a safe and elastic circulation. The convention also appointed an executive committee which did much good work before the recent extra session of Congress, and appointed a commission of prominent men, which is now at Washington, where it proposes to make a thorough and scientific investigation of all the monetary systems of the world. The report of this commission is expected in December or January. This work is an important one, which has unbounded possibilities for good. A sound currency means a basis for good and steady business, while any disturbance of the currency question always results in dull times and slow collections. Any movement designed to secure a permanent and sound currency deserves the support of every manufacturer.

TURNING TURRETS BY ELECTRICITY.

As advocated in the ELECTRICAL REVIEW several weeks ago, Secretary Long, of the Navy Department, has decided to use electric turret-turning gear on three large battleships. This was decided upon after a conference with the Navy Bureau chiefs, in which the hydraulic and steam methods were also considered. Several electrical and shipbuilding firms made bids to install the electrical gear, and the contract was awarded to one which offered to do the work at $10,000 for each ship. This proposal created considerable surprise, as one of the bids was for $175,000 for each ship, while the others were not much lower. It is said that the Navy Department estimates that each installation will cost at least $125,000. Why such a marked discrepancy in the bids should exist has not been explained, but the fact remains that the government has secured a bargain in accepting the lowest bid. Officers in the navy who incline toward the hydraulic method have asserted that it is the best for the purposes required, as heavy turrets can be stopped instantly and exactly by its use, the momentum of the turret being overcome by a complicated system of relief valves. This sudden stopping, starting and overcoming of momentum could not, they argue, be accomplished by means of electrical gear, owing principally to the heavy strains on the apparatus. The Navy Department, it seems, does not agree with this view of the case and have discovered, as have many others before them, that the electric current affords the most flexible power we have at our command to-day. It is evident that one or more of the first-class electrical engineers now in service in the navy have had a chance to be heard before the department finally decided this important question.

In line with the suggestion made in the ELECTRICAL REVIEW last week, the Capital Traction Company, of Washington, D. C., has given orders for the installation of an underground conduit electric railway and for the reconstruction of its cable power-house as an electric power station. The cable conduit will be used, and electric cables are already being strung through them. This is a good example of an opportunity quickly seized, and the officials of the Capital Traction Company are to be congratulated.

Niagara Falls will, once again, welcome the electrical fraternity. From Tuesday to Friday, inclusive, of next week, electric traction advocates will possess the city.

INTERESTING TO STEAM RAILWAY MEN.

HIGHLY FAVORABLE TESTS OF ELECTRICITY FOR CONGESTED SUBURBAN TRAFFIC.

A series of additional train acceleration tests were made October 7 on the experimental track of the General Electric Company at Schenectady in the presence of A. W. Sullivan, general superintendent; W. Renshaw, superintendent of machinery, and John Lundie, consulting engineer of the Illinois Central Railroad, and E. C. Carter, principal assistant engineer of the Chicago & Northwestern Railroad.

The Illinois Central Railroad has contemplated the adoption of electric traction in its suburban service between Van Buren street station and Woodlawn, a distance of about eight miles, using the tracks over which that company carried on the enormous World's Fair passenger traffic. The tests in train acceleration have been urged forward for the purpose of giving a clearer comprehension of the adaptability of electric traction, and of securing that acceleration from rest, which would satisfy the demands of a congested suburban traffic.

The car used on the occasion of these tests was a standard elevated railroad car, weighing, empty, about 25 tons. It was equipped with four 50-horse-power motors, known as G. E. 57, one mounted on each axle, controlled by a standard series parallel controller. In order that the officials present should be able to witness the actual performance of the car, the interior was equipped with voltmeter, ammeter, recording wattmeter and compensated chronograph, with bell attachment, sounding at two-second intervals. Attached to one axle was a Boyer speed recorder, with the gauge on a level with the window.

The car was driven by Mr. W. B. Potter, chief engineer of the railway department, and the tests were made under his direct supervision. A series of 14 runs were made on the tangent of the experimental track—a stretch 3,000 feet long—and the results on the wet track showed that the car, holding 20 people, reached a speed of 19 miles per hour in five seconds; 30 miles per hour in 10 seconds; 35 miles per hour in 15 seconds, and 41 miles an hour in 20 seconds.

This was with a wet and greasy track. During the latter half of the test the rain ceased, and a second series of tests were made with a drier track. The results were more favorable, and a speed of about 41½ miles an hour in 20 seconds was obtained.

Perhaps a better idea of these results may be conveyed by saying that an ordinary elevated steam train would reach a speed of about 14 miles an hour in the same lapse of time, while it would be only possible to accelerate it to the same speed, in the same space of time, by starting it on a down grade of about 15 per cent. The significance of such acceleration may still better be grasped by the fact that it would mean a saving of not less than 15 minutes in the running time over a distance of 10 miles, with the same number of stops as in ordinary suburban or elevated service. The tests are to be continued at Schenectady under varying conditions; that is, with different weights of cars and different equipments.

Mail Sent by Pneumatic Tubes.

The Tubular Dispatch Company inaugurated its work in this city on Thursday of last week by a very successful exhibition. The pneumatic mail tubes from the Post Office to the station in the Produce Exchange were open for business, and many prominent persons were in attendance both at the Post Office and the Produce Exchange. The tubes worked successfully, the round trip being made by parcels in four minutes. A live cat, eggs, books, jokes, champagne and clothing were safely sent by means of these tubes. Among the electrical gentlemen present were General Eckert, of the Western Union Telegraph Company; G. G. Ward, of the Commercial Cable Company; Vice-President Bradley, of the Postal, and Electrician Pickernell, of the American Telephone and Telegraph Company. Mr. John E. Milholland is president of the company, and Dr. L. L. Seaman a prominent director. Hon. Chauncey M. Depew presided on the occasion of the exhibition, and Assistant Postmaster-General Shallenberger, of Washington, was present. President William Berri, of the Brooklyn Bridge, was also in attendance. A collation and speeches of congratulation followed the exhibition.

OBITUARY.

Mr. Albert L. Ide, president of the National Electric Light Company, of Eau Claire, Wis., died suddenly on September 30, while being carried on a cot from the hotel to the railway station at Chetek, Wis., near which place he had been camping. The body was brought on to Eau Claire and taken to the Ide residence in that city. The deceased, whose home was at Springfield, Ill., had been visiting at the home of his son, Mr. Frank Ide, secretary of the National Electric Company, in Eau Claire, most of the time during the past few months. The death of Mr. Ide took place under somewhat singular circumstances. He had been camping about two miles from Chetek, and exposure and fatigue while hunting brought on an attack of illness from which peritonitis developed, resulting in his sudden death. Mr. Ide was about 60 years old. He was the senior partner in the firm of A. L. Ide & Sons, manufacturers of steam engines at Springfield, Ill., and was also the principal stockholder in the Springfield Electric Light and Power Company.

American Electro-Therapeutic Association.

The American Electro-Therapeutic Association held its seventh annual meeting in the Academy of Medicine at Harrisburg, Pa., on September 21, 22 and 23. Committee reports on electrical apparatus used in electrotherapy were read, as well as a number of papers on medical subjects, in which electricity had been used in treatment. The next meeting of the association will be held in Buffalo, N. Y., on the second Tuesday in September, 1898. These officers were elected for the ensuing year: Dr. C. R. Dickson, of Toronto, Canada, president; Drs. Schavoir, of Stamford, Ct., and Brown, of Sac City, Iowa, vice-presidents; Dr. John Gerin, of Auburn, N. Y., secretary; Dr. R. J. Nunn, Savannah, Ga., treasurer.

PERSONAL.

Mr. Frank J. Sprague, of New York city, spent several days of last week in Chicago.

Mr. R. L. McOuat, of Varney & McOuat, dealers in electrical supplies, Indianapolis, Ind., visited New York city last week.

Mr. James E. Keelyn, president of the Western Telephone Construction Company, of Chicago, spent last week in New York city.

President Henry B. Cutter, of the Cutter Electrical Manufacturing Company, Philadelphia, visited the metropolis last week.

President Thomas C. Wood, of the Ball & Wood Company, has returned to New York city, after a vacation of several weeks in Europe.

Mr. W. H. St. John has been elected superintendent of the municipal plant electric lights, waterworks and sewerage, of Grenada, Miss.

Mr. Samuel Ivers, of New Bedford, Mass., well known in telephone circles, honored the city of New York with a visit of a day, Wednesday of last week.

Mr. F. P. Fish, the widely known electrical attorney, has been quite ill for a number of weeks with typhoid fever, but, we are pleased to state, is now improving in health.

Mr. William Stanley, electrician of the Stanley Electric Manufacturing Company, Pittsfield, Mass., was among the prominent electrical visitors to New York city last week.

Mr. John W. Gates, it is rumored, is to resign the presidency of the Illinois Steel Company, to become the head of the Consolidated Steel and Wire Company, with plants in various cities.

Mr. J. C. Reilly, of Brooklyn, N. Y., general superintendent of the New York & New Jersey Telephone Company, returned to his duties last week after a month's vacation spent in Rotterdam, Holland.

Mr. Charles E. Dustin, for years at the head of the Schuyler Electric Company, was a New York visitor last week. Since retiring from the electrical field Mr. Dustin has become interested in irrigation in the western States.

Mr. W. D. Packard, secretary and treasurer of the New York & Ohio Company, of Warren, Ohio, manufacturers of the well known Packard incandescent lamps, visited New York city this week and favored the ELECTRICAL REVIEW office with a call.

Mr. Jacob Cloos, president of the Cloos Engineering Company, Milwaukee, spent a few days in Chicago last week, in the interest of the Cloos high-tension junction box, the merits of which are fast being recognized by those using high-tension currents.

Mr. Samuel Insull, president of the National Electric Light Association, was in the city last week, making his headquarters at the Holland House. While here, he and Vice-President A. M. Young, of Waterbury, Ct., of the same association, held a conference in relation to matters of the electric light association and discussed plans for the next meeting.

Mr. A. C. White, general manager of the Providence Telephone Company, Providence, R. I., was a visitor for a few days in the metropolis last week. Mr. Henry F. White, his son, is now connected with the Western Electric Company, of New York.

Hon. Thomas L. Hamilton, at present a member of the Board of Electrical Control, of New York city, has been nominated for Sheriff of New York County on the regular Republican ticket. Mr. Hamilton is eminently qualified for this important office, and his many friends in the electrical field have already congratulated him on his excellent chances of election.

Mr. A. S. Thweatt, New York, eastern passenger agent of the Southern Railway Company, has had his territory extended to include all of New England and eastern Canada. Mr. Thweatt has many friends in electrical circles, and it was through his courtesy that the passengers on his special train to the Atlanta Street Railway convention in 1894 were privileged to visit Asheville and Biltmore. The Southern Railway has a very efficient representative in Colonel Thweatt.

Mr. Gardiner C. Sims, of Providence, R. I., the founder of the widely known Armington & Sims Engine Company, was warmly welcomed by such of his numerous New York friends as met him on his one-day visit to the metropolis last week. Mr. Sims is again in splendid health, after a severe illness of several weeks. His interests in the Vulcan Foundry Company, of Pawtucket, R. I., are rapidly developing, the company manufacturing all kinds of electric railway equipment and supplies.

A STRONG ELECTRICAL UNION.

THE SPRAGUE ELECTRIC COMPANY INCORPORATED WITH A CAPITAL OF $5,000,000.

The Sprague Electric Company has been incorporated in New Jersey, with principal offices at Bloomfield. The capital is $5,000,000, and of this amount $2,500,000 is preferred.

It is understood that this company has acquired control of the Sprague Electric Elevator Company and the Interior Conduit and Insulation Company, of New York, and that Mr. A. B. Chandler, president of the Postal Telegraph Company, will be the president of the new company, and Mr. E. H. Johnson, first vice-president and general manager, and Mr. Frank J. Sprague, second vice-president and electrical engineer.

The company will undoubtedly be a very strong one, and by taking over the established business of the two houses named will start with a very large and extensive patronage. The electric railway system of Lieutenant Sprague, recently exhibited at Schenectady, is understood to be included in the deal, and Mr. John W. Mackay and Mr. J. Pierpont Morgan are largely interested.

ECONOMY IN ELECTRIC CAR CONTROL.*

BY J. R. CRAVATH.

As electric railroading grows older, and one by one the more serious difficulties which hamper operation are disposed of, the electric railway engineer is enabled to give his attention to economies and improvements that have been heretofore unthought of. With some roads, apparently, the only object of the management is to keep the cars operating, regardless of what the expense may be, but the competent manager is always on the lookout for changes and improvements that will lessen the cost of operation without interfering with the service. There are obviously many ways to reduce operating expenses. It may be done by a reduction of salaries, a reduction of force or a reduction in car service given. But as these methods of reducing expenses are liable to give rise to dissatisfaction on the part of the public and employés, managers always hesitate to resort to them through fear of reduced earnings and increased expenses in other ways, so that the favorite place to look for a reduction of expenses is to the electrical and mechanical department, where it is often possible to reduce expenses without in any way interfering with the service. The item of motive power is usually but a small part of the operating expense of a road. Still a reduction in the cost of motive power involves less risk of loss in other directions than reduction in most other departments, and the same may be said of the repair and maintenance department.

Looking over electric roads as they are operated to-day as compared with some years ago, we find that waste and loss in power and repairs have been reduced in a great many ways, or at least if they have not been on some roads, it is the fault of the management and not of the progress of the art. The most fruitful sources of loss in power and repairs in the past have been inefficient power plants, poor return circuits, and motors and controllers of an early design not suited to railway work. There remains at the present day one chance for economy about which very little has been said, and that chance is at the controller handle. When electric roads were a new thing and it was often difficult to keep enough motors out of the repair shop to operate the road, some managers perhaps realized more keenly the necessity of getting motormen to handle their controllers properly than now, when motors will stand considerable abuse without breaking down at once. Nevertheless, there is, on the majority of roads to-day, a waste of power worth considering from the standpoint of power alone, to say nothing of the repair department. To get a car over the road on time with a minimum of energy drawn from the power plant requires the exercise of considerable skill, care and intelligence on the part of the motorman, and true to human nature, few motormen will exercise such care as long as there is no incentive to do so.

Before going further, let us analyze the matter of electric car control and see where the losses through carelessness may occur. On nearly all electric roads the service is of such a character as to require frequent stopping and starting. If a motorman could operate his car from one end of the road to the other by simply putting his controller handle full on and leaving it there, obviously there would be no chance for either waste or economy, but frequent stops and starts make it possible in practice to waste power in several ways, principally by

1. Turning on current too rapidly in starting.

2. Wasting an unnecessary amount of energy in the brakes.

To operate a car or train between two stops in a given time, we may adopt a variety of methods, as shown by the speed curves A and B in Fig. 1. The curve A shows a quick acceleration and low maximum speed. Since distance covered is the product of speed multiplied by time, the area inclosed by such speed curves represents the distance covered. The area inclosed by A and B is the same, hence the service performed is the same in the two cases. That the theoretical energy required in curve A is less than in curve B is evident from the fact that the energy wasted in the brake-shoes in stopping the train is

$$\text{equal to } \frac{\text{mass} \times \text{velocity}^2}{2} \text{ according to}$$

the law of accelerated bodies, which means, in this case, that with curve B the energy destroyed by the brakes must equal one-half the square on the line $x\ x$, while in the second case the energy wasted in the brakes is half the square on line $y\ y$. Thus the theoretical ideal economy would be secured were we able to accelerate and stop in an infinitely short space of time, as we could then perform the same service with lower maximum speeds. It might be concluded then that the greatest economy would be secured by accelerating as quickly as possible and stopping according to the same principle; and so it would were we able to operate an electric road under ideal conditions, which never exist in practice. The difficulty in carrying out this theoretically correct method of operating cars is that, as a matter of fact, when we attempt to get rapidity of acceleration beyond a certain point we give rise to a number of sources of loss, which more than make up for the gain that results. Quick acceleration is a desirable thing, but there is a limit beyond which we can not go without loss, and it is the constant tendency of motormen to overstep this limit and turn on the power too fast for the best efficiency.

The theoretical amount of energy required to accelerate a car from rest to a given speed is the same whether that power be applied to start the car quickly or slowly, but practically there are elements which enter into and modify this considerably.

The loss in the electrical conductors in the circuit (this includes power-house generators, feeders, trolley lines and ground return) varies according to the square of the current flowing. Thus the motorman who uses the heavy starting current, even though he uses it for a proportionately shorter time, consumes more energy to get his car up to speed than the one who draws his power at a slower rate. For example, let the time of acceleration from zero to certain speed be seven seconds, and the current used during that time 100 amperes. Then by the formula, watt seconds=(currents)^2 by time in seconds by resistance (the resistance being assumed at .2 ohm, corresponding to 20 volts drop), the watt seconds lost in line and generation equals 14,000. If, however, a current of 50 amperes be drawn for 14 seconds through the same line to give the same acceleration, the loss is 7,000 watt seconds.

But this is only one item. When a car is equipped with series-parallel controllers according to the best and most general practice now, there is another chance for waste of power in starting by throwing motors in multiple before they have had opportunity to attain nearly their full speed when in series. When the motors are in series the torque per ampere drawn from the line is double what it is when they are in multiple. Now it is torque per ampere that determines the efficiency of the motors as car accelerators. Consequently, to get the full benefit of the efficiency of a series-parallel controller as a car accelerator, the full use must be made of the series combination of motors. Up to half speed the series-parallel controller affords a means of accelerating a car with but half the current required by a plain multiple controller, but if a motorman skips over the series points and into multiple with scarcely a pause, he is throwing away half the power he uses during a part of the process of acceleration, and the car might as well be equipped with the old wasteful parallel controller.

Very many motor equipments now are provided with a shunt around the field coils, which is intended to be cut in to weaken the fields, to increase the speed after the full speed has been attained by the motors with fully excited fields. The common practice of motormen is to cut in this shunt when the motors are already groaning in an effort to start the car. Weakening the fields at such a time, of course, lowers the torque per ampere that can be obtained from the motors, and, consequently, the efficiency.

It may also be mentioned that, since the energy lost in heating the motors is proportional to the square of the current, the larger current used with the quicker start not only heats them more, so as to endanger the insulation, but heats them so as to sometimes very materially lower their speed and efficiency.

It has been maintained by some that the resistance should be cut out as rapidly as possible in starting, in order to avoid the loss of energy in the resistance. While it is true that it is possible to waste energy by continuing to keep in resistance after a car has attained speed on a point, the unnecessary waste of energy in resistance during actual acceleration is more imaginary than real; first, because it is hard to find a man who will keep it in too long if the time-table is as fast as it should be, and, second, because a little mathematical calculation shows that the resistance introduced during acceleration is a necessary loss which can not be eliminated by too rapid controller handling.

Let $c^2\ r\ t$ = loss in rheostat and motor resistance during any brief interval of time during acceleration. Suppose, now, the resistance be reduced, say, one-half, with the result of doubling the current and dividing by two the acceleration produced during the time. Then

$$(2\ c)^2 \times \frac{r}{2} \times \frac{t}{2} = \text{watts less in}$$

second case, whence by elimination $c\ r\ t$ = w just as in the first case.

However, very slow controller handling is not to be recommended any more than very quick, because, as soon as the car has responded to any one resistance point on a controller, the loss in the resistance begins. An exact analysis of this action is a complex mathematical problem which is not necessary to enter into here.

Before leaving the subject of losses liable to occur in acceleration I must mention a mechanical loss which has not been investigated very thoroughly as yet, but which observation leads me to believe is very extensive on all large roads. I refer to the slipping of wheels when starting. An electric motor gives such a steady torque that slipping of wheels is not very noticeable except by close observation. It is unnecessary to say that the energy so expended in wearing out wheels and rails does no good.

The opportunities for a motorman to save power by allowing the car to drift with current off, thereby using the energy stored up in the car at the time of acceleration, are evident even to the layman. When a car has been brought up to speed it has a momentum which must be destroyed by the brakes as soon as the car has to stop. The less energy, therefore, a motorman has to destroy in the brake-shoes in maintaining a certain schedule time, the more economical he is as a car operator. The amount of drifting he can do depends, of course, on the schedule and the traffic, but under conditions as they exist to-day a great deal of energy is wasted in the brakes unnecessarily.

I have so far considered this subject mainly from the standpoint of energy or watt hours consumed per car mile. There are, however, other considerations which are fully as important as the average power consumption in some special cases. When all the motormen on a road are habitually using excessively large starting currents, the maximum drain on the power plant is such as to require the running of more generating apparatus to provide for the maximum load than would be necessary with a more careful set of motormen, and more feeders are necessary to keep down the fluctuations in voltage.

Still more important than this, in some cases, is the desirability of keeping down repair bills due to abuse of motors by motormen.

To make this paper complete I must briefly refer to the tests that have been made in various ways from time to time by different men, which demonstrate the opportunities for economy by a reform in the common methods of controller handling.

The commercial effect of too rapid turning on of current in starting a car is well illustrated by the results of a number of tests made by Mr. Knox, electrical engineer of the Chicago City Railway in 1895. As they have been published several times I will not reproduce them here. They have since been verified by another series. In one set of tests the controller was put at the top notch in four seconds, and 307,176 watt seconds were used in acceleration, speed being attained in nine and one-half seconds. In the other series the controller was put at the top notch in 10 seconds, and 221,676 watt seconds were used in acceleration, speed being attained in 12 seconds. The maximum drop in voltage was 80 in the first case and 20 in the second. Now, since in city service, according to good authorities, the energy used in acceleration is about 75 per cent of the total energy used by the road, it can be seen how important a bearing it has on the total power consumption to properly handle the controller in starting so as not to waste power. It will be seen that an economical start does not necessarily mean a very slow one, but simply that it requires a little care in advancing the controller.

A Chicago road which is equipped with a device designed by the writer to check the use of excessive starting current by motormen, recently made a saving in coal of 15 per cent to 20 per cent for performing exactly the same service by the use of the instrument, and also reduced the maximum load at the power-house about 25 per cent. This is the result of keeping an individual record of excessive current consumed by each man, and shows the difference between care and carelessness in controller handling.

As showing the difference between

*Read before the Chicago Electrical Association, October 1, 1897.

men and methods of acceleration, I may mention some tests I have in my possession which were made by the officers of a road operating a very heavy, high-speed class of electric service. They were made with a view to determining the best way of operating the particular type of controller used on that road so as to start trains with the smallest possible maximum current, consistent with a fairly fast schedule, and also to determine within what limit the maximum current taken by a train could be kept so as to reduce, as low as possible, the maximum drain on the power-plant and the heating of motors. The tests made covered simply train acceleration. Readings were taken at two-second intervals, from the time each start was begun until the ammeter indicated that full speed was reached. Three men were employed in the test, one to read the ammeter, one to put down readings and one to call time. In one set of tests eight consecutive starts were made by a regular motorman who was one of the best on the road, and was doing his best to make a good showing. Plain rheostat control was employed. The maximum currents he used varied between 300 and 210 amperes, the average of the maximums of the eight starts being 262.5 amperes. The average ampere seconds used per start were 6,814, and the average time per start, 54 seconds. This was thought to be a very good record, and, indeed, it was, as compared with the practice of many men on the same road but on the same trip and under the same conditions, another man, who had been able to give the matter a more intelligent study, took hold and made six consecutive starts, averaging 50⅓ seconds per start, with maximum currents ranging from 200 amperes to 160 amperes. The watt seconds used per start averaged 5,794, and the average of the maximum currents used was 185.

Tests on the same road, including 129 starts with a somewhat lighter train, all tended to confirm the conclusions from the results of the tests just mentioned; viz., that to maintain the schedule of the road, higher maximum starting currents were being commonly used than there was any necessity for, and that the men using the highest maximum starting currents did not necessarily get the quickest or most efficient acceleration, the contrary very often being the case. Thus I notice one run with 12 stops on which the average time per start was 41 seconds; ampere seconds per start, 4,063; average of the maximum readings, 188⅓ amperes. On another run by another man, where 17 stops were made, the average time per start was 25¼ seconds; ampere seconds consumed in start, 2,931, and the average of the maximum current values, 184 amperes. The tests mentioned were all made with the attempt to keep maximums as low as possible, and the maximums were all, of course, lower than in common practice. The gentleman who had the tests in charge tells me that the best results were obtained by working the controller so as to give as smooth an acceleration curve as possible, such as curve C in Fig. 2, rather than curve D. With plain rheostat control as used there, this meant that to keep down the high maximum at the beginning of the start there must be considerable resistance in circuit, and the acceleration must be comparatively slow for the first few seconds, and after that more rapid.

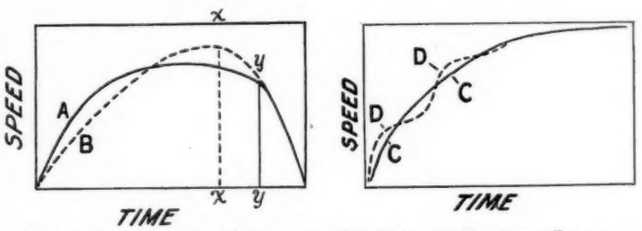
As to the general power consumption of one motorman as compared to another, Hermann S. Hering carried on a number of tests at Baltimore some years ago which showed a difference of 20 per cent in watt hours consumed per car mile in favor of an electrician who acted as motorman, and an above-average motorman making the same round trip. In view of this, one wonders what would have been the difference could the test have been made on some unsuspecting below-the-average motorman.

Some tests made at Terre Haute by L. Gutmann, then of the Westinghouse company, about five years ago, showed, Mr. Gutmann tells me, that a green man used 50 per cent more energy, than one of more experience and skill, in making the same trip on the same day with the same car; the difference in that case being due mainly to the waste of energy in the brakes.

Having discussed the scientific questions involved in economical controller handling, let us now see how a motorman should apply correct principles in the actual operation of a car over the road so as to get the best all-around economical results. In the first place, in starting a car he should pause after each notch long enough to let the car run nearly up to speed on each notch. This does not mean that he should wait until he can detect absolutely no further increase in speed, but he should at least wait until he feels that the motors have responded to the movement of the controller. This will prevent slipping of wheels, jerking of passengers and the use of excessive current. He should be especially careful not to throw from series to multiple until the motors have attained nearly their full series speed. He should also be careful not to move on to a field shunt point before the motors are speeded up on the previous one, or he will waste power and strain armatures. He should always remember that the car should never be accelerated up to full speed when no time is to be gained by doing so. For example, it is very common in city service to see a man run his car up to full speed just before coming to a team on the track, and then, slowing up by hard braking just behind the team, wait several seconds for it to clear the track. He gains no time by such a proceeding, and the energy used in running the car up to speed is immediately wasted in the brake-shoes. In running up behind teams at full speed, when it is sure they will not immediately clear the track, he should shut off current some distance back and let the car drift until nearly there. It is a good general rule to shut off current and drift with brakes off as long before making a stop as is consistent with the schedule time. It is a poor plan to make too gradual stops with the brakes. Let the car drift as long as possible, and then apply the brakes hard enough to make a moderately quick stop. In this way the high speed is maintained for a longer time than when the brakes are set very lightly for a long time, and, consequently, better time can be made with less power. On down grades use the current as little as possible. It will save work with the brakes and power also. All unnecessary stops should be avoided.

The author does not wish to pose as an advocate of snail-like operation of cars, but he does wish to point out the fact that the controller handling on the majority of large city roads is such as to cause a power consumption all out of proportion to the results that might be attained, with no change in schedule. The schedule of 99 out of 100 roads is so fixed that a man can maintain schedule time without violating any of the correct principles spoken of. I believe in fast schedules. It is the way to make a road earn money and the way to please the public, but some means should be provided for insuring that the motormen are doing their best to maintain the schedule with the minimum of energy, and that some men are not using 1,300 watt hours per car mile to maintain a service that other men on the same service and same cars take only 1,000 watt hours to perform, and that some men are not heating their motors to the breaking-down point, while others are not.

As long as there is no incentive to proper controller handling, it is useless to look for any reform on the part of motormen. They are but human and will not worry themselves to save something of which no record is kept. Education of motormen is of little use unless there is some incentive to make them apply it. Probably the majority of large roads employ spotters for the purpose of keeping down abuse of motors, but a few hours spent on any large road will demonstrate that the evil is by no means cured by their services, and it becomes a question whether the salary paid them might not better be spent some other way. Looking at the steam roads, we find that they have settled the question, as far as engineers are concerned, by keeping comparative coal records for each engine crew, and they find it pays many times over for the clerical labor involved, in spite of the fact that many railroad men laughed at the idea several years ago. The day is soon coming, I believe, when its unquestioned economy will drive electric roads to the practice of keeping comparative records of the efficiency of each motorman, just as such roads are being driven, by financial reasons, to keep many other records they did not dream of several years ago.



FIGS. 1. AND 2.—DIAGRAMS ILLUSTRATING MR. CRAVATH'S PAPER ON "ECONOMY IN ELECTRIC CAR CONTROL."

Electric Railways in Great Britain.

There are in the United Kingdom at present not more than 200 miles of track, but most of the lines have been constructed and equipped by American contractors, and all have the overhead trolley, except the new underground in London. The following is a list of the towns in which American electrical systems have been adopted, the mileage, the number of motors employed and the capacity and horse-power of the plants:

	Miles.	Motors.	H.-P.
Bristol	10	36	800
Cork	11	20	460
Coventry	3½	10	240
Dublin	15	60	600
Dublin	5	15	300
Guernsey	3	13	150
Isle of Man	4	15	260
Staffordshire	8	20	600
Brighton	3	10	240
Central London	18	52	1,600

Street Car Air-Brakes in Great Britain.

While General Manager Wessels, of the Standard Air-Brake Company, was in Europe he noticed that the powerful Board of Trade, in London, permitted the use of electric brakes on tram cars in England and Ireland, but that there was no reference made in the government specifications to air-brakes. He at once volunteered to discuss before the Board of Trade the question of the relative merits of air-brakes and electric brakes. The board advised him that it was contrary to precedent for them to have such questions verbally discussed before them, but that they would be glad to hear from him in writing on the subject. Mr. Wessels's faith in air-brakes is so unbounded that he presented an exhaustive argument to the board, in which he showed how widely Standard air-brakes had been adopted in Europe, and that they had become standard and were mentioned in all the specifications in Australia. After weighing his arguments, the Board of Trade sent a letter to Mr. Wessels before his departure for America, reading as follows:

"With reference to your letter of July 8th, on the subject of the use of air brakes on tram cars, I am directed by the Board of Trade to inform you that they are advised that there is no reason why an efficient air-brake should not be allowed by the department."

It will thus be seen that there is no obstacle whatever in the way of Standard air-brakes being adopted by any of the tramways in the United Kingdom, and the Standard Air-Brake Company is to be congratulated on the success achieved.

A Prominent Manufacturing Company Moves to Bronxville, N. Y.

A large granite building has recently been purchased by the Ward Leonard Electric Company at Bronxville, N. Y., the interior of which has been reconstructed and adapted for manufacturing electrical apparatus made by this company. The factory is excellently located, adjoining railroad facilities, and comprises two stone buildings with an acre of land on the bank of the Bronx River. The main building is four stories high and has two wings, the general dimensions of which are 70 by 92, and are of massive structure, the walls being three feet thick at the base. The establishment has been equipped with a complete electric power transmission plant, direct-connected shaft motors being used, and has five generators giving 10, 125, 250 and 500 volts continuous and 1,000 volts alternating current. The steam plant comprises an Armington & Sims engine and return tubular boiler.

The Ward Leonard company report a most satisfactory demand both in this country and abroad for their product. Their principal line is still enamel rheostats, but their new types of automatic circuit-breakers recently marketed have met with a ready sale, and the company are doing a large business also in their porcelain-lined outlet boxes, the price of which is now so low that this last objection to their use has disappeared.

ELECTRIC TRACTION ON COMMON ROADS IN 1895.*

BY DESMOND G. FITZ GERALD.

It seems but the other day—though it is not far from two years ago—that Mr. H. H. Cunynghame, at the Society of Arts, was explaining to a large and scientific audience the simple reason why electrical energy happened to be inapplicable for the propulsion of "locomotive carriages for common roads." "Attempts to turn heat directly into electricity have failed," said Mr. Cunynghame, "and the accumulators at present necessary were very heavy. A storage of one and one-half horse-power to two horse-power is necessary. A horse-power equals, say, 700 watts, which would be afforded by, say, 30 accumulators, giving a current of 22 amperes. The weight would be about one and one-half tons, which practically robbed the carriage of any carrying margin."

That was in November, 1895. On the preceding June 18 had occurred the historical race, or scramble, over the whole or a portion of the 744 miles to be traversed from Paris to Bordeaux and back, of 17 petroleum carriages, seven steam vehicles, two electric carriages, and two petroleum bicycles. Of these only 12 were able to reach Bordeaux, and no electric carriage was amongst them. Eight carriages—one worked by steam and the others by petroleum—completed the journey within the allotted 100 hours.

It was not a case in this trial of rolling along paved streets, nearly level, at seven or eight miles an hour. During the first part of the journey the gradients rise, sometimes abruptly, until, at Limours, the highest point is 168 meters above the sea-level. The pavements of most of the towns and villages through which the vehicles passed were ill made and ill kept. Some portions of the road were so rough and steep that the passengers were obliged to "get down and push behind."

At that period electrical vehicles were, as they are at present, totally unfitted for such a competition. No accumulator subject to the lowest coefficient of traction can transport itself through a distance of 100 miles. No carriage has been built to jolt along with impunity and 1,200 pounds of accumulators over rough roads, steep hills and French pavements, "fanged with hideous stones." No relays of charged accumulators are practicable without organization and a distribution of suitable dynamo machines with skilled attendants. It was merely as an experiment that the pretty electrical carriage of M. Charles Jeantaud, to carry four or six persons, was entered for the race, and the experiment was an unfortunate one. Shortly after leaving Paris an axle heated, and the defect could not then be remedied. The motor, designed by M. Rechniewski to give seven horse-power, was frequently called upon for 14 horse-power and 15 horse-power. This was bad for the motor, and worse for the accumulators. Nevertheless, the vehicle ultimately accomplished the distance between Paris and Bordeaux, though not within the prescribed period, and the experiment afforded data which it is of interest to compare, not only with those assumed by Mr. Cunynghame, but also with those obtained in London and in New York, to which I have referred in this journal.

The battery was that designed by M. Donato Tommasi, of which the main features have been extensively copied, but not very successfully, in this country. It was constructed by the Société Fulmen. It was composed of 38 cells, each weighing 33 pounds. The total weight of the accumulator, without containing boxes, etc., was thus 1,254 pounds; with accessories, the accumulator weighed 1,870 pounds. The total traction weight was 7,040 pounds = 3.14 tons. The speed obtained on the level was 15 miles per hour. The distance traversed, with one charge of the accumulator, was from 25 to 43.5 miles, according to the nature of the road. This works out to 78 to 136 ton-miles. The weight of battery per ton-mile—taking the accumulator with accessories—is from 14 pounds to 24 pounds. Considering the nature of the road, this appears a most noteworthy result. In the New York streets, the weight of battery required per ton-mile is from 30 pounds to 33 pounds. In this country the lowest value is 33 pounds.

With a discharge extending over 10 hours, the capacity of the 33-pound cell was 300 ampere-hours. Thus, when

$$\frac{\text{amperes}}{\text{pound}} = .9, \quad \frac{\text{ampere-hours}}{\text{pound}} = .9$$

The normal rate of discharge was 70 amperes, giving a ratio

$$\frac{\text{amperes}}{\text{pound}} = 2.12.$$

With this rate the capacity was 210 ampere-hours, giving a ratio

$$\frac{\text{ampere-hours}}{\text{pound}} = 6.36.$$

These are *both* very high values, and strike one as being "too good to be true." Yet I doubt not that they can be substantiated. There remains, however, the question of permanency—more or less rapid deterioration, or comparative durability.

For short periods of time the discharge was 200 amperes, giving the ratio

$$\frac{\text{amperes}}{\text{pound}} = 6.$$

Barring the Tudor cell, it would, I think, be difficult, outside of the laboratory, to find another accumulator that could without damage give this rate of discharge for a minute.

Reverting to normal rates, 1,870 pounds, total weight of accumulator and accessories, gave 70 amperes at 70 volts = 4,900 watts = 6.57 horse-power electrical = 4.2 horse-power mechanical. A horse-power effective would therefore be obtained from 445 pounds = .2 ton of accumulator; and, at the time that Mr. Cunynghame was delivering his lecture at the Society of Arts, .2 horse-power effective had been obtained from .4 ton (instead of 1.5 tons) of accumulator. So that there was really a very considerable "carrying margin."

Moreover, the capacity of the accumulator at the normal rate of discharge being 210 ampere hours, the time during which the horse-power effective would be obtained from 445 pounds of accumulator would be

$$\frac{210}{70} = 3 \text{ hours.}$$

* London *Electrical Engineer*.

Telephone Service in New York Residences.

A few years ago telephone service in a New York residence was considered a luxury to be indulged in only by the very rich. At that time the entire list of subscribers had less than half the extent it has to-day, and the use of the service was confined principally to business houses. Moreover, the area covered by the system was much less than at present, and the facilities for out-of-town communications much more restricted; and, most salient point of all, the rate—considering the average use of the service made by a private residence—was about double the present figures. To-day the scope of the service has vastly extended, both as regards number and variety of subscribers and the area covered by the system, while the facilities for reaching out-of-town points, either distant or nearby, have been largely improved and extended. At the same time the rates, owing to the adoption of the practical and equitable method of charging according to the subscriber's use of the service, have been reduced beyond all expectation. The consequence is that the use of the service among residences has increased so rapidly that it has almost come to be considered that no first-class private house is completely equipped unless it has connection with the telephone system.

To thoroughly appreciate the convenience and value of telephone service in a New York house, one must have a little experience of the practical working from the user's point of view. One who has such experience gives the following impressions:

"We have had a telephone in the house for over a year, and I can think of no part of our household equipment that we would not dispense with sooner than with the connection with the telephone service. The cost is merely nominal, taken in connection with the running expenses of a fair-sized household. The first 600 messages you send cost 15 cents apiece, and after that they cost first 10 cents, then eight, and so on down to five, which is cheap enough, considering what one can do with a telephone message. All the messages you receive cost you nothing, as the message is always charged to the originating station. In this way from $8 to $10 a month pays for all the telephone service the usual private house needs, for the actual amount of use is not severely great. One or two calls a day dispose of a vast amount of business with tradespeople and bring the question of supplies up to the acme of comfort and promptness. An occasional call is expended in hurrying up a delinquent purveyor or in supplying a deficiency caused by some one's oversight or forgetfulness. The amount of heartburning and worry saved in this way is often worth a month's subscription for a single call. You have within half a minute of your orders all the principal caterers, grocers and markets in New York, and most of the big stores in the residence districts are now also within call, until it seems to show a lack of enterprise for a store that depends for its custom on the residences in the district not to have the service. In bad weather the telephone is a positive boon, as everything can be arranged for, from a carriage to a pair of rubbers, and brought to the door before one need put one's foot outside it. I know a lady who does not indulge in carriages and found it absolutely necessary to go out one very snowy day; the pair of rubbers she had were no longer waterproof, but the telephone service was, so she called up a leading shoe store nearby and asked them to send some rubbers. They promptly did so and she selected a pair and sallied forth with a clear conscience and dry feet. That is only an instance of what can be done with the telephone service when one is resourceful enough to know how to use it in emergencies.

"Speaking of emergencies, you have right there what is to my mind one of the chief points of value in telephone service at a residence. With the telephone in your house you are in touch with all departments of the life of the city at any moment of the day or night. There are all sorts of emergencies always coming up, changes of plans, arrangements for social affairs to be made or altered, journeys to be arranged for, friends coming to town you want to get hold of quickly, and so on. They can almost always be settled by telephone, certainly more quickly than in any other way, and often when any other way would be impossible, because time would not allow. You can get any livery stable, express company, railway or steamer ticket office, theater or hotel in New York in a few seconds, no matter what part of the city you live in. Although all this is of immense convenience, and makes itself felt frequently enough, what is a good deal more important is that with the telephone service one feels secure against the graver emergencies of every-day life. In case of sudden illness or accident in the house, you can get your doctor or *a* doctor by telephone at any hour, for most doctors who have a practice of any size now have the service. For a fire in your house, or near it, you can give the alarm a great deal more quickly than by running to the box at the corner, even if it is at the nearest corner to your house, because in a few seconds you can be switched on to fire headquarters, whence the alarm is instantly telegraphed to the proper point. There have been cases of the police being called in by telephone to cope with burglars plying their gentle trade all unconscious that news of their presence had been wired over their heads to those most anxious to meet them. I think a fair proportion of one's telephone rental may be considered a sort of general insurance premium. Even if one put down the whole of the minimum rental, $7.50 a month, to this account, I scarcely think it would be excessive, and I believe it will not be long before no moderately well appointed residence will be considered completely equipped if it is not connected to the telephone system.

The necessary papers have been perfected for the consolidation of the Hoosick, N. Y., Railway Company and the Bennington Electric Railroad Company. The name of the new company will be the Bennington & Hoosick Valley Railway Company.

ADVANTAGES OF UP-TO-DATE STREET RAILROAD SERVICE—WHY THE RATE OF FARE SHOULD NOT BE REDUCED.*

BY C. L. ROSSITER.

One has only to recall the wretched transportation facilities of horse-car days to appreciate the advantages of an up-to-date street railway. We remember the small, dimly lighted horse cars, so cold in Winter that straw was placed in them to keep the feet warm, and so poorly lighted that it was impossible to read in them. Insufficient horse-power frequently made it necessary for passengers to get out and assist the horses on the steep grades. To-day over 80 per cent of the street railways in this country are operated by electricity, and millions of new capital have been expended in constructing the necessary new tracks, cars, electric equipment and expensive power-houses, so that to ride in one of the modern cars of an electric railway to-day is a positive pleasure, and thousands of dollars of the income now received by the roads come from this pleasure riding.

The electric street railway to-day is essential to every city, not less so than its departments of sewers, water and street lighting, and in fact the railroad in nearly every case is the pioneer in all the improvements and building up of the city. The railroad corporations are very frequently looked upon as being antagonistic to the city's interests, and both the public and the city are oftentimes inclined to impose unjust burdens and hardships upon the roads, when, in fact, the capital to construct the railroads is furnished by banks, trust companies and organizations having in their trust the savings of the people.

It is only a few years since the western part of our country was almost unknown, its wonderful fertility and resources of no profit to mankind. It required only the railroads to make possible the populating of it, building up its vast area and bringing its enormous yields of grain to the eastern market, thus adding untold wealth to our nation. In the same way the up-to-date electric railway opens up the suburbs of our cities and makes it possible for those of moderate means to find pleasant and healthful homes, obtainable in no other way, and enriching the city by adding to its taxable value.

The purchase of a piece of farm land for building purposes in the suburbs of any of our cities is followed immediately by a request upon the local railway to extend its line, and without such extensions it will be found that the city itself will be very slow to make expenditures for the improvement of the streets and sewers, water mains, etc., and next to impossible to get the gas and other companies to extend. In support of this statement some figures in regard to Boston are very instructive, showing as they do in the case of Brookline, a suburb of Boston, that in the 30 years from 1855 to 1885 the increase in value was from $5,500,000 to $16,000,000, while in the next five years, with the introduction of the street railway, the values increased to $30,000,000. Another case that will illustrate this has occurred in Brooklyn. During the year 1896 one of the roads constructed an extension some three miles in length through an entirely new territory where the streets for blocks had not been cut through, and no improvements whatever made to the adjoining property. To-day, less than a year since the road was opened, there have been over 500 houses constructed (nearly all of them being occupied as soon as completed) on the line of this street and adjacent side streets. If it had not been for the railroad extension not one of these houses would have been built, and it can be readily seen that it is not the railroad company which will reap the first benefits, but the city, which will have increased its assessment roll not less than $3,000,000 in the present year, and the opportunity given to hundreds of individuals of finding comfortable homes. If the city and the public treat the railroad companies justly and fairly, there will be no trouble caused by the policy that the companies pursue, as nothing pays better to the owners of the railroad property or to the city itself than to have an up-to-date railway in its cars, equipment, tracks and facilities, and the roads can be trusted, as they continue to be prosperous, to give the greater part of every nickel that is taken in to the public in the shape of good wages to their employés, thus securing competent and reliable men, and also expending, as it can afford to do so, the necessary money for extensions as required, and for new cars and equipment properly maintained, and the companies will continue this policy so long as the public shows appreciation of it by patronizing the cars. On the other hand, if the earnings of the road are not sufficient to properly and well maintain the property, the spectacle of old cars and equipment and negligent employés will be seen, and while this means loss to those who have invested, it is no less a direct loss to the city and the public which has such a railroad. To secure the needed funds for extensions and improvements of our electric roads there must be a perfect understanding between the city and the owners of these properties. If the city places unnecessary burdens and taxes on the roads that can not be met, then those who are called upon to furnish the capital will refuse to do so, and the city will be the loser tenfold over what it could possibly gain in any other way.

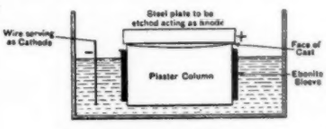
I believe the street surface railway to be as necessary to a city as its street, sewer, water and gas systems, and if the railways to-day can maintain friendly relations with the city's representatives and give to them and to the public full information as to the financial and physical condition of the properties, a much better understanding will be had, and the final result will be to secure the good will of those on whom the success of the railroads depend. An up-to-date street railway service pays the company itself, particularly if it has a competitor who is not up to date, and it pays the city and the public in the immediate benefits they receive in clean, attractive cars, good service and freedom from accidents, and it pays the employés of such a company to be identified with it and to assist in bringing such a result about, as well as in good wages promptly paid.

In regard to the matter of fares and why they should not be reduced, I want to say at the outset they have been reduced, and to-day the street railways of this country are carrying passengers a longer distance and at cheaper fares than in any other country in the world. The distances in the 10 largest cities in this country, where the public is carried for a single fare of five cents, range from 9.9 miles to 18 miles; this latter in Brooklyn. In horse-car days a ride of five miles for a single fare was a long one, and the average was below this. The railways in Glasgow, Berlin and some other foreign cities are frequently referred to as furnishing lower rates of fare. This is not so. On the contrary they are not only much higher, but have many disadvantages which would not be tolerated in this country. The average and usual rate in England is two cents for the first mile and one cent for each mile thereafter, and this works injury to the laborer and artisan classes. In this country the average rate is from one-quarter to one-half cent per mile, and in many cases less than one-third cent per mile. Abroad five representative cities average 11,099 population per mile of track.

Seven of the largest cities in this country average 2,127 population per mile of track. This means that the laboring classes and artisans abroad are compelled, on account of the high rates of fare to the suburbs, to live in the crowded quarters of the city, to the menace of their health, and this overcrowding and density of population is causing much concern to the cities; while the railroads in this country, with five times the track and facilities to the same population, give to those who desire it the opportunity of finding comfortable homes in the suburbs, where their families can be properly brought up. In the matter of wages of conductors and drivers, in England they receive from 85 cents to $1.12 per day of 10 hours. In this country the conductors and motormen receive from $1.75 to $2.25 per day of 10 hours. Very many trips are run on all our roads for the accommodation of the public, on which the revenue taken in does not equal the wages of the conductors and motormen; and the average street railway to-day, with the luxurious and comfortable electric car, well lighted, and well heated in Winter, gives the cheapest transportation in the world.

It has been said that it would be an ideal condition to have the street railways all confined to some lonely field in the remote country, where they could be run on time, never crowded, and quite unobjectionable—but quite useless also. But as crowded thoroughfares are unavoidable in a large city and means of transit indispensable, the problem is how best to accomplish it to the benefit of all concerned. Complaint is too often made without cause and without reason. The fact is that most of the roads are giving better service to the public than they can afford, the trouble being that the people expect too much for five cents.

*Read before the New York State Street Railway Association, September 15, 1897.



ELECTROLYTIC ETCHING.

L. L. Brown, William Hayes Laird and John Dietze, of Winona, Minn., have made application to the City Council for a 50-year franchise to construct and operate a light, heat and power plant. If the franchise is granted these gentlemen will incorporate the People's Light and Power Company, with a capital stock of $80,000.

Electrolytic Etching.

A process has been patented in Germany by Herr Josef Rieder, of Thalkirchen, near Munich, by which it is said to be possible to obtain exact reproductions of articles in low relief, such as medals and clichés, in hard steel, says the London *Electrician*. The process does not depend on any modification of the well known method of aciertype, which consists in providing a soft metal plate or electrotype with a hard steel-like face of electro-deposited iron, but produces a replica of the original article in solid steel. The fundamental idea is simple enough. Plaster of Paris is poured on the article (*e. g.*, a coin), of which a cast is to be taken, so as to form a column several centimetres in height. This is detached from the coin and fitted with an ebonite sleeve, so that the face and the corresponding blank at the opposite end of the short column of plaster are alone exposed. The cast is put face upwards in a vessel containing an electrolyte such as ammonium chloride; the face projects above the level of the liquid, which can only reach the face by absorption through the column of plaster. A piece of steel on which it is desired to etch a reproduction of the coin is placed on the face of the cast, and is made the anode of the cell. The cathode is a wide spiral placed in the liquid in which the plaster column stands. The whole arrangement may be represented diagrammatically thus: On the high parts of the cast the steel plates rest, and at those points a current flows, dissolving the steel and allowing it to settle down into the cast; the process of dissolution proceeds until the whole surface of the steel is in contact with that of the cast; *i. e.*, a relief has been produced through the plaster intaglio, identical with the original relief, or vice versa, as the case may be.

Of course, many working details have to be attended to in order to obtain a satisfactory result. It is found that a high voltage—10 to 15 volts—and a current density of 0.2 to 0.5 ampere per square centimetre are effective, and that the electrolyte is best prepared by electrolytically dissolving an iron anode in a solution of ammonium chloride. Also the constituents of the steel, notably carbon, which are left when the metal is dissolved, must be removed from time to time from the surface of the steel which is being etched. This cleansing must be as often as once every five or ten seconds, when a high-current density is used, and in practice it will be necessary to perform this automatically and to replace the steel on the cast with mathematical accuracy. It has been found possible to etch a steel blank in about the relief of a 20 mark piece in a period of three hours, a time which seems moderate enough.

One of the greatest needs for the development of the process is said to be some material to replace the plaster of Paris, which is too soft and soluble for continuous work. Even as it is, the process presents many possibilities of use, and is likely to be improved and put on a practical manufacturing footing.

ADVANCE INFORMATION

Electric Light and Power.

MACON, GA.—A new electric light company is to be organized to establish an electric light plant.

FAYETTEVILLE, N. C.—The Mayor can give information concerning establishment of electric light plant.

BERLIN, MD.—An electric light plant will be erected in this city.

FERNANDINA, FLA.—The city will add to its electric arc system a 1,000 16-candle-power-light incandescent dynamo, with engine and boiler, etc. A new power-house will also be erected.

COCHRAN, GA.—Electric light plant and waterworks will be erected. E. H. Smith can be addressed.

MACON, GA.—A movement is on foot to organize a new electric light company to supply the city and business buildings.

SUMTER, S. C.—The Sumter Electric Company will put in a 200-horse-power Corliss engine.

CHARLESTON, S. C.—The Charleston Edison Light and Power Company has been incorporated by Byron T. Burt, of Charleston; Henry M. Francis, of Brooklyn, N. Y., and S. Dana Greene, of Schenectady, N. Y. Capital stock is to be $100,000.

FAYETTEVILLE, N. C.—An electric light plant will probably be established in this city.

CASSELTON, N. D. — The city council, by a unanimous vote, decided to put in an electric light plant at a cost not to exceed $6,000.

CHRISTIANA, PA. — The electric light plant has made extensive improvements, and run a line to Atgler and one to the Gap, lighting both places.

CORUNNA, MICH. — An election will be held here October 15 to decide the question of bonding the city for money to purchase an electric lighting plant.

ATTICA, N. Y.—F. C. Stevens, of Attica, is now about to put in an electric light plant for the purpose of furnishing lights for the barns and houses of his Maplewood stock farm.

PORT HURON, MICH.—Francis E. Hatch and three other Detroit men have organized a company to furnish electric light, heat and power to the cities, towns and villages of Dickinson County in the upper peninsula. They have secured control of all the water-power of the Sturgeon River, in that county, a valuable acquisition.

UTICA, N. Y.—The Utica Electrical Manufacturing and Supply Company has been awarded a contract to install a complete electric light plant for the Oriskany Malleable Iron Company. The plant will include 250 incandescent lamps and a full complement of arc lights.

CAIRO, MICH.—The electric light contract has been let for another five years to the Cairo Electric Light Company.

CENTERVILLE, MICH.—The Centerville Electric Light and Water Company, with a paid-up capital of $10,000, has been organized to construct an electric lighting plant as soon as arrangements for power can be made with Wolf Brothers. The town will shortly be lighted in a modern way.

HOUMA, LA.—R. L. Zalenka may be addressed concerning erection of new electric light plant at this place. They are in the market for 25 arc lights and 750 sixteen-candle-power incandescent lights.

RICHMOND, TEX.—Bassett & Winston will probably install an electric light plant at this place.

JACKSONVILLE, FLA. — Address Board of Public Works concerning proposed improvements and enlargements to the city electric light plant, to the extent of $30,000.

CHICAGO, ILL. — The Commonwealth Electric Company, recently organized, will erect an electric plant for the purpose of furnishing light, heat, power and the transmission of sounds and signals over the entire city.

SCRANTON, PA.—The Taylor Electric Light Company is preparing to enlarge its plant.

UNION, S. C.—An electric light plant will be established in this city.

OAKLAND, CAL.—The electric light and water questions are being agitated here.

RANTOUL, ILL.—The new electric light is now complete and in good working order.

POTTERSVILLE FALLS, VT.—Work is progressing finely on the electric light plant at this place.

ROCHESTER, N. H. — A five-year contract has been signed with the United Gas and Electric Company of Dover for the lighting of this city.

TYNDALL, S. D. — An electric light plant is being discussed for this city. The power is to be furnished by the large engines in the city mills, and the plant is reasonably certain to be in active operation by December 1 next.

New Electric Railways.

GETTYSBURG, PA. — New York capitalists are reported to be interested in the project to build an electric railway from Washington, D. C., to Gettysburg.

SAGINAW, MICH.—An electric road will probably be built from Fort Huron to Saginaw Valley.

SPRINGFIELD, MASS. — A new trolley line will probably be built from Springfield to Hartford.

JERSEY CITY, N. J.—The Electric Vehicle Company has been incorporated by Gustav E. Kissel, Philip Lehman and Edward Tuck; to make vehicles propelled by electricity. Capital stock, $10,000,000.

BALTIMORE, MD.—The Baltimore & Northern electric railway, which is to connect Arlington, Pikesville, Mount Washington and other points, is nearing completion.

SOUTH BETHLEHEM, PA.—A new traction line is being constructed which will connect South Bethlehem and Hellertown by trolley.

ROCKLAND, CT.—The Hartford, Manchester & Rockland Tramway Company has enlarged its electrical power plant at South Manchester.

DOLGEVILLE, N. Y.—Electrician Myers has been engaged in preparing the lighting and power lines connected with the new power-house at High Falls.

GREEN BAY, WIS.—A. Shewmon, of this city, has applied for a franchise for an electric line from the city of Waupaca to the Chain of Lakes, a Summer resort near by, and also connecting the city with the Soldiers' Home. The line will be about five miles in length, and will run through the city of Waupaca and town of Farmington. It will be operated by water-power, and will be run only during the Summer season.

WICHITA, KAS.—The contract for rebuilding and refitting the Wichita city street railway system has been let entire to J. Holt Gates & Company, of Chicago.

PORTAGE, N. Y.—An electric railway line is to be built between this place and Pike. Hon. Greenleaf S. Van Gorder is interested. The cost of the line will be raised by popular subscription, part of which is already guaranteed by Van Gorder.

WABASH, IND.—An electric street railway for this place is again being agitated, and a number of Wabash citizens of means are interested in the matter.

DETROIT, MICH.—The extension of the Sandwich, Windsor & Amherstburg Electric Railway from the mineral springs in Sandwich to Chappel's has been completed, and the line is now open for general traffic.

BIRMINGHAM, ALA.—The Birmingham Traction Company contemplates changing its railway to the electric system.

STAUNTON, VA.—An electric road will be built from Staunton to Monterey, for which $50,000 will be appropriated.

LONG BRANCH, N. J.—The Board of Commissioners of this city recently granted the Atlantic Highlands, Red Bank & Long Branch Electric Railway Company permission to lay a double track in Broadway as far as Martin street, and to operate the same by electricity for 99 years.

TOLEDO, OHIO — The Toledo, Bowling Green & Fremont Electric Railway Company have made a proposition to extend their lines to Fremont, Ohio, providing the city will furnish a depot site, secure the right of way from Fremont to Gibsonburg, and take some of the bonds of the railway company.

ALBANY, N. Y.—An electric railroad is being built from Herkimer to Little Falls on the south side of the river, through Fort Herkimer and Jacksonburg.

New Telephone and Telegraph Companies.

SPRINGFIELD, MINN.—Work has been begun on the telephone line which will connect this place with New Ulm, Mankato and the cities. There has been enough support already pledged to make the enterprise a success, and the line will be finished by the last of November.

MANSFIELD, LA.—The De Soto Telephone Company has been organized with P. E. Allen, president; A. F. Jackson, general manager, and E. G. Hinkle, secretary-treasurer. The line is to connect Mansfield and Shreeveport. Capital stock, $5,000.

SUMMERVILLE, PA.—Steps are being taken to extend the Summerville Telephone Company to Du Bois.

CUMBERLAND, MD.—A long-distance telephone line is being built between Cumberland and Hagerstown.

GRAYS, KY.—The East Tennessee Telephone Company will soon open an office here.

PRAIRIE DU CHIEN, WIS.—The new telephone line from this place to La Crosse has been completed.

NEW LONDON, OHIO—The People's Telephone Company has just completed a line between Ashland and New London. It will be continued to Rochester, Wellington, Clarksfield and Norwalk. Preparations are being made to put in an exchange at this place.

JACKSON, MICH.—The board of public works has granted the Bell Telephone Company permission to lay its wires underground.

SHERMAN, TEX.—The Postal Telegraph Company has completed all arrangements for the transmission of messages over their line from this point.

SCOTTSVILLE, VA.—The new telephone line established by Lane Brothers & Company, to connect this place with Esmont, is nearly ready to go into operation.

COOKEVILLE, TENN.—A telephone line has been constructed from Lebanon to Monterey, along the line of the N. & K. R. R. track.

New Incorporations.

WACO, TEX.—The Waco Electrical Supply Company has been organized, with a capital stock of $10,000.

BALTIMORE, MD.—The Northern Electric Company has been organized, with John M. Denison, president; Col. Charles Marshall, vice-president; Chas. M. Armstrong, secretary and treasurer, and J. Frank Morrison, general superintendent.

DETROIT, MICH.—The American Electric Signal Company has been incorporated by Marcus F. Parrish, Myron Wells Parrish, William Reid, James Dean, Frederick Zabriskie and J. H. Carstens. Capital stock, $50,000.

RHEA COUNTY, TENN.—The Wheeler Electric and Manufacturing Company has been incorporated by J. T. Dean, J. F. Johnson, G. W. Johnson, W. E. Wheeler and W. B. Miller.

Kindred.... ...Interests

L. A. Chase & Company, Fort Hill Square, Boston, report a satisfactory increase in business.

The Eastern Electric Cable Company, Boston, is very busy, and its manufacturing plant is running to its full capacity.

The Pacific Electric Company, of La Crosse, Wis., have been awarded the contract for installing the plant in the La Crosse Rubber Company's mills in La Crosse, Westinghouse machinery being used.

The new Chicago address of the Manhattan General Construction Company is 1511 Monadnock Building, at which place Mr. Geo. W. Conover holds sway. There is no doubt that the Manhattan lamp will continue to be recognized as among the highly popular ones, under the guidance and management of Mr. Conover, in his territory.

The Lake Shore & Michigan Southern Railway will carry a large number of delegates to the American Street Railway Convention at Niagara Falls, October 19–22. Special cars will be put on at Chicago, and passengers at Sandusky, Cleveland, Erie and other points along the line will take advantage of the excellent passenger facilities of this line.

Comstock, Cheney & Company, of Ivoryton, Ct., are erecting a fireproof building about 50 feet long. The side walls of the building are of brick and the roof is constructed of iron. The covering is corrugated iron, lined with the Berlin Iron Bridge Company's anti-condensation fireproof roof lining. The above company also furnishes and erects all of the steel work of the roof.

The Western Electric Company, Chicago, is sending out an advertising card containing handsome halftones of its inclosed arc lamps for constant-potential, direct-current circuits. These lamps can be operated singly on 110 volts, two in series on 120 volts, and five in series on 550 volts. The Western Electric Company reports that this line of lamps is giving perfect satisfaction to a large number of users.

The Philip Carey Manufacturing Company, of Lockland, Ohio, are the sole manufacturers of Carey's asbestos-magnesia steam-pipe and boiler coverings, which are particularly well adapted for electric and power plants. This company also make ammonia and brine-pipe sectional coverings, asbestos cements, fibers, etc., and magnesia flexible cement roofing, roofing paints and materials, asbestos products, etc.

The C & C Electric Company, of New York, reports great activity in the power transmission department of its business, and also having recently secured several large and most desirable orders for extensive and complete electric transmissions. The most recent one is an order for a complete equipment for a railroad shop in Japan, making the second large order of similar nature within a few weeks. Much praise is given the new type C & C inclosed, ironclad slow-speed motors and dynamos. The company is securing a vast number of orders for the new type of multipolar dynamos for belt and direct connection, and is running extensive works, with increased force, day and night in an endeavor to promptly fill ever-increasing orders.

The Provincial Exhibition, of Nova Scotia, is just now being held, and the local papers pronounce it a grand success, and give glowing accounts of the electrical exhibit of John Starr, Son & Company, Limited, of Halifax, which is said to surpass anything hitherto seen in Canada, being a more general exhibit of all kinds of electrical appliances than is generally shown. It was visited by Lord and Lady Kelvin, the Governor-General, Lord Aberdeen and the Countess of Aberdeen, Admiral Sir John Fisher and Lady Fisher, and a host of celebrities, who were much interested in the electrical novelties displayed, and Lord Kelvin expressed himself as highly pleased at the exhibit. The Countess of Aberdeen handled the main switch and the branch switches in turning on the current at the switchboard with the dexterity of an expert.

The Clonbrock Steam Boiler Company, of Brooklyn, N. Y., announce a very bright prospect ahead for business, with many orders to be delivered at once, and many sales just past. They have secured also the entire power plant required by the Trans-Mississippi and International Exposition Company, Omaha, Neb., which is the great triumph of the Climax boiler.

Among their most recent sales are the following: The Salt Lake County Light, Heat, Power and Cold Storage Company, Salt Lake City, Utah, four 250-horse-power boilers; Queen Dyeing Company, Providence, R. I., one 400-horse-power boiler; the United Electric Light and Power Company, New York city, three 600-horse-power boilers; the Providence Gas Company, Providence, R. I., one 250-horse-power boiler, second order; the Converse Building, Boston, Mass., two 125-horse-power boilers; the Roxbury Gas Company, Roxbury, Mass., two 50-horse-power boilers; the Economy Light, Heat and Power Company, Scranton, Pa., two 300-horse-power boilers; Peoples' Light and Power Company, Jersey City, N. J., one 600-horse-power boiler, fourth order; Whitney Factory, North Attleborough, Mass., one 80-horse-power boiler; Brazer Building, Boston, Mass., two 90-horse-power boilers; New Jersey and Pennsylvania Construction Works, Edison, N. J., two 350-horse-power boilers, third order; Riverside Iron Works, Wheeling, W. Va., two 550-horse-power boilers, twelfth order; Tennessee Centennial Exposition Company, Nashville, Tenn., 2,500-horse-power; Providence Gas Company, Providence, R. I., one 200-horse-power boiler; the Crescent Insulated Wire and Cable Company, Trenton, N. J., one 200-horse-power boiler; Jacksonville Electric Light Company, Jacksonville, Fla., one 200-horse-power boiler; the Jersey City, Hoboken & Rutherford Electric Railway Company, Rutherford, N. J., one 350-horse-power boiler, second order; Geo. Watkinson & Company, Rubber Works, Philadelphia, Pa., one 300-horse-power boiler, second order; Peoples' Light and Power Company, Orange, N. J., two 600-horse-power boilers; New York Steam Company, East Sixtieth street, New York city, two 1,000-horse-power boilers; Hazleton Manufacturing Company, Hazleton, Pa., two 200-horse-power boilers; the American Manufacturing Company, Brooklyn, N. Y., one 500-horse-power boiler, second order; Mathieson Alkali Works, Saltville, Va., one 500-horse-power boiler, second order; Latimer & Fernandez, St. John, Porto Rico, one 250-horse-power boiler; Edison Electric Light Company, York, Pa., one 350-horse-power boiler.

$7,800 GIVEN AWAY

To persons making the greatest number of words out of the phrase "Patent Attorney Wedderburn." For full particulars, write the National Recorder, Washington, D. C., for sample copy containing same.

J. G. WHITE & COMPANY,
Incorporated,
ENGINEERS, CONTRACTORS.
Successors to White-Crosby Company, and J. G. White & Co.,
29 BROADWAY, NEW YORK, N. Y.
Baltimore Office, Equitable Building.

THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Room 1206 Bowling Green Offices, 11 Broadway, N. Y.
Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

ROYCE & MAREAN,
DEALERS IN
Electrical Supplies,
WASHINGTON, D. C.

TELEPHONE SERVICE
in New York City is
Far-reaching,
covering forty square miles and 20,000 stations;
Efficient,
the service never stops night or day, and the speed of operating is high;
Economical,
the rates are strictly proportional to the subscriber's use and begin at $90 a year.
NEW YORK TELEPHONE CO.,
15 Dey St. 952 Broadway, 115 W. 38th St.

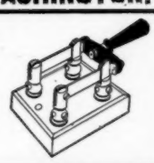
THIS CO HAS BEEN MAKING
TELEPHONES
20 YEARS, NOT CHEAP BUT SERVICEABLE AND FULLY GUARANTEED.
CIRCULARS FURNISHED.
VIADUCT ELECTRIC Co
BALTIMORE, MD., U. S. A.

MECHANICAL DRAWING
Machine Design; Stationary, Locomotive and Marine Engineering; Electricity; Plumbing; Architecture; Architectural Drawing; Railroad, Municipal, Hydraulic & Bridge Engineering; Surveying and Mapping; Sheet Metal Pattern Cutting; Bookkeep'g; Shorthand; English Branches; Mining; Metal Prospecting.
31 COURSES
All who study **GUARANTEED SUCCESS.**
Fees Moderate, Advance or Installments.
Circular Free: State subject you wish to study.
International Correspondence Schools, Box 1008, Scranton, Pa.

McINTIRE'S PATENT
CONNECTORS AND TERMINALS.
Special Connectors for HARD-DRAWN COPPER WIRE, *All Sizes.*
Fused Wire, Fused Links and Strips.
The C. McINTIRE CO., 13 & 15 Franklin Street,
Newark, N. J.

IMPROVED AND NOW PERFECT.
THE "ESPERSEN ADJUSTABLE SHADE LAMPS."

Made in ten different styles and colors to suit purchaser. Write for Discounts and Catalogue "D." Good Agents wanted in the U. S. and Europe.
PACIFIC ELECTRIC CO.,
120 Main Street, La Crosse, Wis.


MAKING KNIFE-SWITCHES OUR SPECIALTY
Write for full particulars, etc.
Two new styles of Baby
KNIFE-SWITCHES
Low Prices—that's wealth to you.
H. T. PAISTE CO.
CHICAGO PHILADELPHIA

BAKER & CO.,
IMPORTERS, MELTERS AND REFINERS OF
PLATINUM,
408, 410, 412 and 414 N. J. R. R. Ave., NEWARK, N. J.
Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native Platinum purchased
NEW YORK OFFICE: 121 LIBERTY STREET.

RUBBER COVERED
WIRES AND CABLES FOR EVERY SERVICE.
For Underground, Aerial and Submarine use, "Safety" wires and cables have the indorsement of some of the largest users in the United States. Write for our booklet containing the experience of users.
THE SAFETY INSULATED WIRE & CABLE CO.,
225 to 239 West 28th Street, New York.
LEONARD F. REQUA, General Manager.

TO EARN MORE, LEARN MORE
The Correspondence School of Technology, Cleveland, Ohio.
ELECTRICAL, Mechanical, Steam and Other Engineering Branches Taught by Mail. Courses for all: $14 to $120—Monthly Payments.
E. P. Roberts, M. E., Prest. Send for Catalogue. *J. C. Gallup, Secretary.*
Representative for Greater New York: MAX OSTERBERG, E. E., Consulting Engineer, 27 Thames Building, New York City.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED SEPTEMBER 28, 1897.

590,777 Magnetic brake; W. Stanley, Pittsfield, Mass.—Consists of a permanent magnet having a stationery body portion, and metallic disk rotating in the field thereof, said magnet having polar projections, adjustable in a direction vertical to the plane of said disk.

590,813 Controller circuit-breaker; T. von Zwigbergk, Cleveland, Ohio.

590,838 Incandescent electric lamp fixture; B. B. Hoffman, New York city.

590,852 Electrical transformer; W. D. Packert, Warren, Ohio—In an electrical converter, core plates composed of strips of magnetic metal bent to form corners between the portions thereof.

590,881 590,882 Electric railway; J. W. Darley, Jr., Baltimore, Md.—Consists of a truck, a magnet frame provided with grooved tracks at each end thereof, mounted independently of said truck, magnets suspended from rollers traveling in said grooved tracks with means for moving said magnets laterly and means operated by said magnets for completing the electric circuit through the motor on the car.

590,910 Rheostat; T. M. Pusey, Kennettsquare, Pa.

590,916 Electric heater; R. A. Snyder, Pittsburgh, Pa.—A metallic part to be heated, a metallic core, layers of resistance wire arranged on the core and insulated therefrom, a metallic strip between the said layers of resistance wire and insulated therefrom, said strip in metallic contact with the part to be heated.

ISSUED OCTOBER 5, 1897.

591,002 Electric bell-chiming apparatus; N. McMenamin, Trenton, N. J.

591,010 Automatic test circuit; L. G. Rowand, Camden, N. J.

591,011 Telephone system; A. W. Rose, New York, N. Y.

591,024 Dynamo-electric machine; M. E. Thompson, Ridgway, Pa.—Consists of a coil of wire having a binding wrapper, as of cord, and studs projecting from the faces of the coil and having feet engaging under the wrapper.

591,026 Electric arc lamp; C. S. Van Nuis, New Brunswick, N. J.

591,042 Trolley for electric cars; W. L. Harvie, Newton, Mass.

591,071 Electric gas lighting apparatus; A. L. Bogart, Jamaica, N. Y.—A main gas-supply pipe, a by-pass, valves for independently controlling the main supply and by-pass, a flash ladder connected to the by pass, an electric igniter and means for operating the said igniter and jets to be ignited by the flash light

591,081 Method of magnetizing; W. D. Marks, Philadelphia, Pa.—The method of tempering and magnetizing steel, consisting in first heating the steel to a sufficient degree, then simultaneously subjecting the heated steel to the influence of a magnet and immersing the heated steel in a tempering bath.

591,100 Electric railway; J. C. Henry, Denver, Colo.—Consists of a plurality of electric supply circuits, a series of motors having their fields excited from one of said circuits by a circuit independent of the armature circuits, and variable connections between the supply circuits and the armatures of said motors.

591,104 Insulator for electric wires; W. Roberts, Mobile, Ala.—A wire attaching and insulating device provided with a transverse opening, a slot to admit the wire into said opening, and a groove intersecting said slot, and adapted to receive and retain the wire.

591,105 Electro-magnetic braiding machine.

591,123 Igniting means for explosive engines; V. G. Apple, Miamisburg, Ohio.

591,126 Plug switch; W. R. Cole, Detroit, Mich.—Consists of two parallel insulator plates apertured in line with each other, a spring-socket contact placed in each aperture, and ears on said sockets extending between and clamped by said plates serving to hold said sockets in position out of contact with each other.

591,127 Telephone exchange system; W. R Cole, Detroit, Mich.

591,141 Process of, and apparatus for, electrolytic extraction of metals from their solutions; J. W. Richards, Bethlehem, Pa.

591,160 Electric apparatus for surgical purposes; W. E. Dow, Braintree, Mass.

591,179 Annunciator; F. P. Stevens, Colorado Springs, Colo.

591,182 Electric arc lamp; E. P. Warner, Chicago, Ill.

591,193 Multiple switchboard for telephone exchanges; W. S. Nash, Knoxville, Tenn.

591,194 Method of, and apparatus for, multiple rate metering for electric currents; E. Oxley, Washington, D. C.—A meter, a control switch and circuit, an armature circuit for the meter, a branch of said circuit containing a definite resistance, and a vibratory bar carrying a switch which is connected to a return wire to insert and withdraw said resistance in and from the armature circuit of said meter, and electromagnets and circuits operated by the control switch.

591,195 Method of, and apparatus for, multiple rate metering for electric currents; E. Oxley, Washington, D. C.

591,201 Electrical exchange; A. B. Strowger, F. A. Lundquist, Chicago.

591,203 Commutator for dynamo-electric machines; J. J. Wood, Fort Wayne, Ind.

591,217 Electric clock; C. Gullberg, Jersey City, N. J.

591,226 Junction box; Jacob Cloos, Milwaukee, Wis.—A junction box, a feeder and main conductors leading thereto and extending therefrom, a bus bar, bars or conductors with which the feeder or feeders are connected, and switching mechanism for uniting the mains with said bus bar or bars.

591,240 Phase adjusting method and means for alternating current apparatus; O. B. Shallenberger, Rochester, Pa.

KIND WORDS.

A GOOD INVESTMENT.

TO THE EDITOR OF ELECTRICAL REVIEW:

Inclosed please find check for subscription to the ELECTRICAL REVIEW for the period of one year. I renew my subscription with pleasure, as it is an investment unequaled hereabouts. With best wishes.

Yours truly,
G. W. F.

Milan, Italy, September 27.

"WESTINGHOUSE ELECTRIC STREET-CAR EQUIPMENT."

A VALUABLE UP-TO-DATE BOOK,

containing a description of the various motors, controllers, and other electric street-car apparatus manufactured by the Westinghouse Electric and Manufacturing Company; with detailed instructions for the operation, inspection and repair of same; also full directions for locating and remedying faults.

By FREDERICK L. HUTCHINSON and LEO A. PHILLIPS.

The authors have aimed to give practical rather than theoretical information.
The book is neatly bound in a flexible leather cover. The pages are 7 in. x 4½ in.—a convenient pocket size.
The writers are both engineers in the employ of the Westinghouse Company, and associate members of the American Institute of Electrical Engineers.

PRICE, $1.00.

Address
ELECTRICAL REVIEW,
Times Building, New York.

—FOR SALE:—

A lot of Second-Hand Boilers, Engines, Pumps, Series Arc Dynamos, Direct and Alternating-Current Generators.

INTENDING PURCHASERS WILL SAVE MONEY BY SENDING TO US FOR PRICES.

Chicago Edison Company,

189 ADAMS STREET, CHICAGO.

Do You Want Gold?

Every one desires to keep informed on Yukon, the Klondike and Alaskan gold fields. Send 10 cents for large compendium of vast information and big color map to Hamilton Publishing Company, Indianapolis, Ind.

Wanted—An Idea Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write JOHN WEDDERBURN & CO., Patent Attorneys, Washington, D. C., for their $1,800 prize offer and list of two hundred inventions wanted.

PATENTS.

TRADE MARKS. DESIGNS. COPYRIGHTS.

CAN YOU OBTAIN A PATENT?

Send me a model or drawing of your invention, and a description, and I will examine same and advise you promptly. My fees are moderate in all Patent matters, and I can obtain a Patent in the shortest possible time.

All patents taken out through me are given special notice in the leading journals of the country, thus bringing same widely before the public without cost to inventor.

REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

EDW. S. DUVALL, Solicitor of Patents. Loan and Trust Bldg., WASHINGTON, D. C.

STORAGE BATTERIES
THE WILLARD BATTERY CO, CLEVELAND, O.

DYER & DRISCOLL,
PATENT SOLICITORS,
31 NASSAU STREET, N. Y.

Have done all my patent solicitor work, both for this and foreign countries, continuously for the past fourteen years.
Thomas A. Edison

PATENT OFFICE.

EDWARD P. THOMPSON,
Registered Patent Attorney, No. 386.

Established in 1883. Over 300 Clients.
Evening appointments made.
Experienced in patent business by correspondence. Start by sending description of invention, for estimate.
PROF. WM. A. ANTHONY, Associate Expert.
ALFRED C. COURSEN, Associate Counsel.

REPRESENTATIVE CLIENTS AS REFERENCES:
Mica Insulator Co., ($5,000 of patent business), No. 218 Water St., city.
Prof. Sidney H. Short (won interference case and traveled 5,300 miles taking testimony), Cleveland, Ohio.
Prof. Dugald C. Jackson, University of Wis., Madison, Wis.
Prof. Benj. F. Thomas, Ph. D. O. State Univ., Columbus, O.
Ludwig Gutman (63 U. S. and Foreign), Peoria, Ill.
Colt & Co., 115 Nassau St., city.
D. McFarlan Moore (32 U. S. and Foreign), Moore Electric Co., 52 Lawrence St., Newark, N. J.
Royal Electric Co., Peoria, Ill.
Jerome Carty, Philadelphia, Pa.
W. P. Widdifield, assignor to Westinghouse Air Brake Co. (Patents obtained in U. S., Canada, Great Britain, France, Germany, Belgium, Italy, Spain, Russia, India, Austria, Hungary). Uxbridge, Ontario.
Edward J. Willis, Supt. Richmond Traction Co., Richmond, Va.

Address EDWARD P. THOMPSON,
119 Nassau, cor. Beekman St., New York.

ELECTRIC CONDENSERS.
WM. MARSHALL,
Manufacturer.
STANDARDS A SPECIALTY.
708 LEXINGTON AVENUE. NEW YORK.

"Dixie." The Southern Industrial Journal, tells the truth about Southern conditions and possibilities. If you are interested, send 25 cents for 3 months or $1 per year. THE "DIXIE" CO., Atlanta, Ga.

"BIG FOUR"
THREE GREAT TRAINS.
"KNICKERBOCKER SPECIAL"
Between ST. LOUIS, INDIANAPOLIS, CLEVELAND, NEW YORK and BOSTON.
"SOUTHWESTERN LIMITED"
Between CINCINNATI, COLUMBUS, CLEVELAND, NEW YORK and BOSTON.
"WHITE CITY SPECIAL"
Between CINCINNATI, INDIANAPOLIS and CHICAGO.

E. O. McCORMICK, Pass. Traffic Mgr. D. B. MARTIN, Genl. Pass. & Ticket Agt.

W. R. OSTRANDER & CO.

22 DEY STREET,
Manufacturers of
SPEAKING TUBES, WHISTLES, ANNUNCIATORS.
Electric and Mechanical Bells.
FACTORY,
DE KALB AVENUE, BROOKLYN.

Send for Illustrated Catalogue.

GORDON PRIMARY CELL

The increasing popularity of the Gordon Primary Cell among the Fire Alarm and Police Signal Service of the leading cities, the railroad, telegraph and telephone companies, and the general adoption of our steel enameled cell for gas-engine, launch and marine service attest most highly to its merit, efficiency, adaptability and economic features.
If you wish to read the testimonials in its behalf, and learn its full description, kindly apply for circular and price-list, to
GORDON-BURNHAM BATTERY CO.,
32 to 36 WEST BROADWAY, NEW YORK CITY.